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# USSR Report

MILITARY AFFAIRS

AVIATION AND COSMONAUTICS

No. 11, November 1984

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13 February 1985

USSR REPORT  
MILITARY AFFAIRS

## AVIATION AND COSMONAUTICS

No. 11, November 1984

Except where indicated otherwise in the table of contents the following is a complete translation of the Russian-language monthly journal AVIATSIYA I KOSMONAVTIKA published in Moscow.

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#### SKORIKOV SUMMARIZES 1984 TRAINING RESULTS

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 11, Nov 84 (signed to press 3 Oct 84) pp 1-3

[Article by Mar Avn Grigoriy Petrovich Skorikov, chief of the Air Forces Main Staff and first deputy commander in chief of the Air Forces: "With the Name of Lenin, Under the Banner of the Party"]

[Text] The entirety of modern history is inseparably linked with the name of Vladimir Il'ich Lenin. Lenin's ideas exerted and continue to exert the most profound influence on the entire course of worldwide development. Many peoples and countries, at various stages of economic and cultural development, have already taken the socialist road. There is no other and can be no other future for mankind. The transition to socialism with the resulting end to exploitation and poverty, production anarchy and intellectual stagnation, deprivation of social rights and ethnic inequality corresponds to the aspirations of the majority of the population -- the toilers.

As for the world of capitalism, as was noted at the June (1983) CPSU Central Committee Plenum, we are witness to a considerable deepening of the general crisis of this societal system. It is becoming increasingly clearer that imperialism is incapable of coping with the social consequences of the scientific and technological revolution, which is of unprecedented depth and scale, where millions upon millions of toilers are doomed to unemployment and poverty; it has become entangled in internal and intergovernmental antagonisms, upheavals, and conflicts. The imperialist reactionaries are undertaking attempts to turn back the wheel of history at all costs. There is taking place in the international arena an acute aggravation, unprecedented during the entire postwar period, of the struggle between two societal systems, two diametrically opposed ideologies.

An integral teaching on war and peace occupies an exceptionally important place in the theory and practice of Leninism. The main thing in this teaching is the idea of an organic link between peace and socialism. The new society has no desire for war. War is in conflict with all its interests and ideals and all the aspirations of working people.

The Soviet Socialist State, engendered by the Great October Revolution, proclaimed from the very first days of its existence a policy of peace,

defense and independence of all peoples, as a counterbalance to the imperialist policy of oppression, wars of aggression and enslavement of other peoples. One of the first decrees of the Soviet State was the Lenin Peace Decree, adopted by the 2nd Congress of Soviets on 26 October (8 November) 1917.

Peace cannot be obtained from the imperialists by the asking. We remember Lenin's behest: a revolution must have the ability to defend itself. The birth of the Soviet Armed Forces and their heroic history are inseparably linked with the name of V. I. Lenin. It is he who made the fundamental decisions pertaining to organization of a Red Air Fleet, which he insightfully viewed not only as a mode of transportation and communications in peacetime but also as a powerful means of defending revolutionary achievements. Throughout the entire history of the Soviet State our Armed Forces have carried their colors with honor in the struggle with the enemy, have defended the freedom and independence of the socialist homeland, and saved the peoples of the world from fascist enslavement.

Soviet aviators displayed selfless devotion to the party and people and love for the homeland in the battle with fascism. They rose up in its defense with their very lives and demonstrated unprecedented heroism. Of the 100,000 aircraft lost by the Hitlerites in World War II, 77,000 were destroyed on the Soviet-German front, and 57,000 of these by Soviet military aviation.

The party teaches us that we should remember the lessons of the Great Patriotic War. The most important of these lessons is that one must struggle against war before it begins. This requires unified, aggressive actions on the part of all peace-loving forces. The Soviet Union has never proceeded from the position that a firm peace can be secured solely by military force and a policy grounded on military force. Such a policy would lead not to peace but to an arms race, to confrontation and, in the final analysis, to war. Precisely for this reason our party and the Soviet State purposefully defend principles of peaceful coexistence and unswervingly pursue a policy of peace and international cooperation.

At the same time we must clearly realize that an unchecked arms race and treachery on the part of the forces of reaction and militarism oblige us to display unrelenting vigilance. "The present situation," stressed CPSU Central Committee General Secretary Comrade K. U. Chernenko, chairman of the Presidium of the USSR Supreme Soviet, at the April (1984) CPSU Central Committee Plenum, "demands of us continuous and comprehensive efforts to ensure our country's security and reliable defense of the peaceful labor of Soviet citizens." Level of combat readiness is the principal criterion of party and government assessment of the qualitative state of training of Air Forces units. It encompasses the capability of aviation combined units and units to be prepared to act immediately, on signal, in an organized fashion and in a minimum time, and successfully to accomplish assigned combat missions in conditions of employment of all modern weaponry, in all weather, day and night, with maximum intensity and minimal losses.

Combat readiness is characterized by the time required to make aviation units takeoff-ready (from the time the alert is sounded to takeoff) and by their

battleworthiness, that is, the combat proficiency of aircrews in combination with the capabilities of the aircraft in service. Unquestionably both indicators are interlinked and influence one another. There are a large number of factors which determine combat readiness. They include personnel and combat equipment strength level; condition of aircraft, weapons, control and support facilities; level of combat proficiency of flight personnel, political-morale state and military discipline of personnel; troop leadership skill of commanders; availability of prepared command and control agencies; adequate supply of materiel and readiness of airfields; readiness of assets for immediate action. Combat readiness is formed day by day of a great many large and small items. There are no finite boundaries in improving it, just as there are no "trivial items" which can be ignored. One should never rest on one's laurels. Nothing is as harmful as smug complacency.

The complexity of today's international situation and the achieved level of technological development presently impose heightened demands on Air Forces officer personnel. It is essential in large degree to resolve in a new manner matters pertaining to command and control, teamwork and cooperation among units and subunits. The key to success lies in splendid knowledge and expert employment of weapons and combat equipment, excellent organizing ability, broad knowledgeability, breadth of thought, and a feeling for the new.

A qualitative leap forward in the development of weaponry and addition to the arsenal of the armies of the aggressive NATO bloc of new kinds of high-precision weapons (AWACS, PLSS, Assault Breaker), which comprehensively accomplish the tasks of reconnaissance, command and control, and strike delivery on close to a real-time basis, create the prerequisites for the adversary to prepare for and deliver a sneak attack with conventional weapons, without advance deployment of forces.

This obliges us comprehensively to take into account aggressive preparations by imperialism for war, to take response measures in a prompt and timely manner to increase the combat readiness of the Air Forces, continuously to improve skill in penetrating hostile air defense, and to make every effort to boost the level of operational and tactical training of leader personnel and aircrews, as well as stability, reliability and efficiency of command and control of aviation units through automation of command and control processes on the basis of modern control and communications hardware. In the course of combat training it is essential to display innovativeness and to seek tactical devices which the adversary does not expect, especially methods of seeking out and destroying his newest weaponry.

An important role in accomplishing tasks of strengthening combat readiness should be played by purposeful ideological indoctrination work. I should like to mention once again that work with personnel is a complex and important job. It tolerates neither indifference nor excessive attention to form with consequent detriment to content. It is essential not only skillfully to command subordinates, to give them orders in an intelligent manner, but also to effect systematic individual political, military and moral-ethical indoctrination. It is important for an aviation commander to possess comprehensive knowledge of the personal qualities, interests, and needs of each of his men, to have confidence in others, and to respect their merit.



We remember with reverence V. I. Lenin's behest: "In any war victory in the final analysis is determined by the state of morale of those masses which shed their blood on the field of battle. Conviction that the war is just and awareness of the necessity of sacrificing one's own life for the welfare of one's brothers raises soldiers' spirit and allows them to stand up under unprecedented hardships."

This obliges commanders and political workers at all echelons to work more persistently and purposefully to mold a Marxist-Leninist ideological outlook in Air Forces personnel, to instill selfless dedication to the cause of the Leninist Party and Communist ideals, a love of the socialist homeland, proletarian internationalism, and a strong feeling of responsibility for safeguarding the peaceful labor of the Soviet people and for reliable defense of the historic achievements of socialism.

V. I. Lenin attached enormous importance to one-man command, to strong military discipline, and a high degree of vigilance on the part of all personnel. He stated: "...The highest degree of military discipline and military vigilance are essential," "...Adopt self-discipline, obey at all costs, in order to ensure exemplary order...." In present-day conditions an important role in carrying out these instructions should be assigned to a well-balanced system of publicity of the demands of the oath and military regulations.

Socialist competition -- a powerful accelerator of our forward movement -- should be utilized in full measure. It is important to concentrate the efforts of competing personnel on key areas in accomplishing the tasks of strengthening combat readiness, boosting proficiency ratings, and achieving consummate mastery of weapons and combat equipment. We must firmly bear in mind that new hardware demands a higher level of mastery. Here as well it is important to take note of the new in a prompt and timely manner, to support initiative, and to issue an appeal to learn from the finest examples.

The training year is coming to an end. Results are gratifying. Exercises on various scale constituted a good test of the proficiency and fighting skills of commanders, staff officers, and all personnel. At these exercises aviation personnel displayed excellent knowledge and consummate mastery of combat equipment and weapons, excellent organizational abilities, and broad tactical knowledgeability.

At one exercise, for example, aviation personnel had to operate in a complex air and weather environment. They were performing blind bombing. On the whole they successfully accomplished the assigned missions. The best results were achieved by the aircrews of the outfits under the command of officers V. Perelomov, A. Zemlyanoy, B. Kozhemyako, G. Kuznetsov, and G. Kochergin. They fully accomplished all missions and inflicted heavy damage on the targets.

We shall be celebrating the 40th anniversary of the Great Victory as a major national holiday. Victory Day is infinitely dear to the heart of each and every one of us. Years and decades pass, new generations are born and grow



up, but the great feat accomplished by the Soviet Union in battle against Hitlerite fascism will never fade in the nation's memory.

Preparations for celebrating the 40th anniversary of the Victory of the Soviet people in the Great Patriotic War should foster successful implementation of the decisions of the 26th CPSU Congress and subsequent CPSU Central Committee plenums. We can already state with assurance that the patriotic enthusiasm of aviation personnel is directed toward further improving combat and political training, toward forming excellent moral-political and fighting qualities, and toward the endeavor to add to the combat fame of the Air Forces with concrete deeds.

The main task of combat and political training -- to teach troops that which is essential in war -- is being successfully accomplished. And there are many positive examples. At one exercise, for example, excellent flying skill, coolness and self-control were demonstrated by helicopter crews which were performing missions of landing tactical airborne assault forces at high-mountain and difficult-access sites, as well as evacuating "the wounded and sick" both day and night. In these cases specially equipped helicopters and crews, capable of landing on these sites, were readied. The crews of officers A. Lykov, A. Kim, M. Ignat'yev, and V. Korolenko accomplished the missions most successfully. These are sons and grandsons of combat veterans, ideologically conditioned, totally devoted to the cause of communism, bold and intrepid fighting men, possessing a high degree of flying skill.

Aviators of the postwar generation include a great many Heroes of the Soviet Union. They include officers V. Gaynutdinov, G. Yeliseyev, I. Zhukov, Ye. Zel'nyakov, V. Kot, V. Pavlov, V. Shcherbakov, and others. They distinguished themselves in military labor in mastering new equipment and weapons and in carrying out the responsible tasks assigned by the Communist Party and Soviet Government.

The Air Forces, working in a close unity with the air forces of the brother Warsaw Pact member nations, are prepared at all times to come to the defense of their homeland and the nations of the socialist community, to carry out their patriotic and internationalist duty in a worthy manner.

Today's accomplishments of the Soviet people are a direct continuation of the exploits of the October Revolution and practical embodiment of Lenin's ideas. Leninism is a reliable compass of revolutionary transformations, a genuine science of winning.

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## FIGHTER REGIMENT REPORTS IMPROVED PERFORMANCE

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 11, Nov 84 (signed to press 3 Oct 84) p 3

[Article, published under the heading "Implementing the Recommendations of the 6th Armed Forces Conference of Primary Party Organization Secretaries," by Capt V. Vasil'yev: "Adopting Advanced Know-How"]

[Text] The "aggressor" aircraft were attempting to penetrate through to the target at extremely low level, exploiting the adverse weather and terrain. The fighters of the excellent-rated flight under the command of Capt V. Shayakhmetov scrambled to make the intercept. Executing a maneuver, they attacked the "enemy," taking him by surprise. The intercept was executed masterfully. The squadron's other pilots also successfully accomplished the mission.

Party committee member Maj A. Fomin was observing the aerial clash from the command post. He did not conceal his satisfaction: the interceptors' excellent performance in the air was a result of persistent efforts by the aviators to master the "secrets" of flying skill, a result of work by commanders, political workers, and the members of the party committee in training the combat pilots.

The pilots of the squadron commanded by Maj M. Shemet were among the first in the aviation regiment to fly extremely low-level intercepts. This was a new kind of mission for them. A meeting of the methods council was held in the regiment. Some time later appropriate pilot training recommendations were drawn up.

Several months passed. At one of the party committee meetings a resolution was adopted to synthesize the experience and know-how of the vanguard performers. Soon a selection of materials appeared in the party committee, revealing thoroughly and in detail the work forms and methods of the squadron commander, political worker, and party buro during the period of mastery of new tactics by the aviators.

In the other squadrons, however, they were taking their time about adopting advanced know-how into the practical training of the combat pilots. Such an attitude toward things could not please the regimental command authorities or

the party committee. What benefit is derived from know-how which remains unutilized? Effective measures were taken. For example, a report by one of the squadron commanders on improvement in his professional level and work with his flight commanders was presented at a meeting of the party committee. They also discussed the fact that the know-how of the performance leaders was still being adopted too slowly in the subunit, and yet that know-how is precisely what might be needed by every pilot in actual combat. Party members held their comrade strictly to account for his errors of omission. Some time later the know-how of the vanguard performers was adopted into the practical training of the subunit's aviators.

This example is typical of the work style of the regimental party committee. Implementing the demands of the 26th CPSU Congress and subsequent CPSU Central Committee plenums, and the recommendations of the 6th Armed Forces Conference of Primary Party Organization Secretaries, the people in the regiment have a solicitous attitude toward all new and advanced innovations engendered by practical combat training and socialist competition. Activists do not limit themselves merely to noting and supporting new innovations. They realize that experience is valuable by repetition, and therefore they are persistent and firm when the question at hand deals with practical adoption into combat training of all things which help increase aviation personnel combat readiness and skill.

For example, the men of the squadron in which Capt N. Sokolov serves succeeded in achieving an appreciable reduction in the time required to make the subunit combat-ready. The outfit's achievements were duly appreciated. The regimental commander and party committee took pains to ensure that the reserve potential for increasing combat readiness which was revealed and utilized in the excellent-rated squadron also benefited other subunits. In particular, experience in readying aircraft for flight on the signal to assemble was approved. There were also a good many useful items in organization of the work of engineer and technical personnel during the period of tactical air exercises. And there are many such examples.

In the training year the unit's aviation personnel have become actively involved in socialist competition and are successfully accomplishing their combat training tasks. This is being greatly assisted by the work being done by the command authorities and party organization directed toward aggressive utilization of reserve potential for increasing the effectiveness of the training process, including practical adoption of the experience and know-how of vanguard performers.

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#### PECULIARITIES OF MOUNTAIN-TERRAIN AIR SUPPORT CONSIDERED

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 11, Nov 84 (signed to press 3 Oct 84) pp 4-5

[Article, published under the heading "Be Alert, In a Continuous State of Combat Readiness," by Military Pilot Expert Marksman Col M. Konfindratov: "The Mountains Teach, the Mountains Toughen"]

[Text] The airfield was still enveloped in the black of night, but on the flight line preparation of aircraft for flight operations was already in full swing. Atactical air exercise was commencing. Squadron commander Maj N. Blinov was receiving a briefing update minute by minute. A report, which he had been awaiting, came in from the reconnaissance pilots: an "aggressor" raiding party was moving along concealed mountain trails toward the positions of the ground subunits.

The commanding officer drew on the map a penciled circle showing the "aggressor's" current location. Unquestionably the riflemen had to be given support. His first choice would be to deliver a massive area-target rocket and bomb strike. This idea had to be rejected, however, for the "aggressor" had taken refuge in the mountains, where aircraft maneuvering is difficult.

The squadron commander summoned flight commander Maj K. Kitoroga and his pilots. Briefing them on the situation, he asked all of them to think the situation over and give their opinion. The pilots studied the map and analyzed conditions.

The flight commander stated after a brief pause: "We should check the raiding party's presumed route. I am sure we will find a convenient spot to hit it."

The squadron commander backed up this suggestion. The pilots determined several routes of movement through the mountains which were the most advantageous from the standpoint of the foot soldier. All of them converged in a single comparatively deep and narrow gorge.

"We shall hit them here," decided Major Blinov. "We don't have much time. We must quickly make our calculations, thoroughly study readily identifiable terrain features, and choose a specific strike variation."



But it is not so easy to select a readily-identifiable terrain feature in mountain country, even on a large-scale map. Selection of approach and strike maneuver requires that one take into consideration elevation of mountains and steepness of slopes, depth of valleys and gorges. This determines both the mode of strike and type of maneuver.

All the necessary calculations were made. The pilots went through a mission "dry run" and a cockpit drill.

In the meantime the "aggressor" raiding party approached the gorge, as had been surmised. Recon scouts and a forward air controller were keeping close watch on the party's advance, while remaining unobserved. Major Kitoroga's flight took to the air in response to a command from the FAC.

The terrain below presented a monotonous succession of seemingly identical mountain peaks. The flight commander closely monitored his stopwatch. At the calculated time the flight leader gave the command to open up the formation. Soon a reference terrain feature appeared -- a high, sharp-peaked mountain. A deep valley debouched to the right of the mountain.

Major Kitoroga put his aircraft into a steep dive and, executing a swinging turn, entered the gorge. The aircraft had commenced its bombing run. At this time the pilot received over the radio refined target designation data from the FAC. He placed his sight graticule on the designated reference point. At the specified range the major pressed the release button and pulled back on the controls. The fighter-bomber surged skyward. Powerful explosions shook the mountains. Rocks rained down the mountain slopes, blocking the only trail. The "aggressor's" avenue of retreat was cut off.

Wingman Capt V. Korobeynikov, following on the heels of the flight commander and executing the target designation instructions of the FAC, released bombs at the gorge exit end. The rock trap snapped shut.

By this time Maj G. Shapovalov's two-aircraft element arrived. Sequentially -- first the leader and then his wingman, Capt V. Smirnov -- they hit the target. The thunderous echo continued to reverberate through the mountains.

The exercise continued.

Major Blinov was given a new mission. It was necessary to provide air support to ground subunits during an assault on a high-ground objective. Executing a march across a broad valley, without a pause they commenced to assault a tactically important height. At first the advance proceeded smoothly. But the "aggressor," withdrawing to higher ground, took up advantageous positions and offered stubborn resistance. It appeared impossible to break through the heavy screen of fire without air assistance.

The squadron commander decided to lead a group to knock out the "aggressor" position. Even a superficial analysis of the situation indicated that it would be no simple matter to accomplish this mission. According to information obtained from their motorized riflemen, the position was protected on the flanks by comparatively high mountains and on the rear by a sheer rock



cliff. Thus a bomb strike could be flown from only one, far from advantageous direction. In addition, the strike techniques which had been rehearsed during combat training sorties on flatland terrain were clearly unsuited here. Consulting with his pilots, Major Blinov decided to employ one of the variations already in their repertoire.

The group took to the air at the specified time. After crossing the final en route waypoint, the leader gave the command to assume a dispersed configuration in order to hit the target sequentially. Visually identifying the target, he initiated the attack. The commander's wingmen followed. At this moment antiaircraft weapons opened up from the mountains on the flanks of the "aggressor's" defensive position. There was nobody available to provide cover for the attacking aircraft. Their strike proved little effective.

Upon their return to the airfield, the pilots gathered in a classroom. Each of them realized that the mission had essentially not been accomplished, and only because the selected method of strike delivery had proven unsuited to mountain conditions.

"Frankly, the result was to be expected," stated the squadron commander. "The fact is that in our routine training drills we became accustomed to operating in an unoriginal manner, without departing from standard methods. But a situation developed like in actual combat, and we were unable to accomplish the assigned mission. That is the price of unnecessary situation simplification and lack of initiative. The mission is not being cancelled. We must think, look for a new solution."

The pilots set to work. Ultimately a solution took shape: since the "aggressor" was delivering fire from different directions, the leader would deliver the strike, while the wingmen would place suppressive fire on the flanking weapons. They laid out a different approach route to the target. Upon verifying his aircrews' preparedness, Major Blinov reported the decision to the command post and, receiving approval, proceeded to lead his group to the target.

The "aggressor" was ready, however. As soon as the leader's aircraft turned onto its attack run, heavy fire opened up from the flanks. At this time the covering aircraft dived at the antiaircraft positions and neutralized them with rockets. The leader, executing a complicated maneuver, delivered a precision strike. The "aggressor" strongpoint was destroyed. The motorized riflemen resumed the assault and soon controlled the high-ground objective.

After their return to the airfield, the squadron commander gave a post-mission debriefing. The technique, which had proven to be highly effective, became, as it were, a point of departure in the innovative quest for new tactics.

In the course of the tactical air exercise the crews flew various missions in support of the combat actions of ground subunits. The pilots acquired skills in flying in mountain-terrain conditions, in terrain orientation and target search, in organizing coordination in the air and with motorized rifle troops being supported. In addition, this tactical air exercise demonstrated how important it is thoroughly to study the ground and air environment, to predict

actions by the adversary and his air defense assets, to analyze tactics, and precisely to determine modes of strike delivery.

As experience has shown, pilot actions in mountain terrain are highly specific. The extremely rugged topography makes search and observation more difficult, while a lack of continuous radar coverage complicates monitoring, command and control of aircrews from the ground. Nor is it a simple matter to select a direction of attack in mountain terrain. In addition, the sudden development of low cloud cover in areas between mountains, in valleys and gorges, abrupt change in wind direction and velocity, as well as temperature drops create additional difficulties for flying procedures, navigation and orientation. It has happened that aircrews would take off in VFR weather and would subsequently land at IFR minimums.

Mountains are a harsh schoolmaster. They do not forgive unnecessary situation simplification in flight training or fixed patterns in carrying out combat training missions. In the process of flying sorties over mountain terrain, the pilots of the squadron under the command of Maj N. Blinov have determined optimal clearance heights for crossing over mountain ranges and passes, safe distances from the forward positions of friendly ground subunits when attacking ground targets, and the most advantageous parameters of aircraft flying formations during simultaneous, sequential, and one-by-one attack on a target. This resulted in increased pilot confidence in their abilities, strengthened their moral-psychological fortitude, and increased their combat readiness.

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## SOCIALIST COMPETITION AT AIRCRAFT OVERHAUL FACILITY

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 11, Nov 24 (signed to press 3 Oct 84) p 5

[Article, published under the heading "Visiting Innovation Initiators," by Lt Col G. Zabelin: "Further Building Upon Labor Achievements"]

[Text] "We shall mark the 40th anniversary of the Great Victory with new labor successes!" stated workers, engineers, technicians, and white-collar employees at a political rally at the Communist labor enterprise headed by Col V. Mironov. This was a special day. An appeal to related Air Forces aircraft repair and overhaul enterprises had been adopted at the mass meeting, calling on them to support the patriotic initiative of the Muscovites, who initiated socialist competition under the slogan "Forty shock-work labor weeks in honor of the 40th anniversary of the Victory of the Soviet people in the Great Patriotic War!"

Socialist competition among aircraft repair and overhaul workers is in full swing. In recent months the number of shock-work labor shifts have been devoted to memorable events of the past war. Propagandists, agitators, and political briefing personnel in the sections, shops, and brigades told about the crushing defeat of German-fascist forces in major operations, the courage and steadfastness of the people's avengers -- partisans -- behind enemy lines, as well as unprecedented deeds by Komsomol members and other young people.

Communists march in the vanguard of competition. Just as during the terrible war years, they are marching in the front ranks, inspiring others to follow. Party full members and probationary members are concerned not only with their personal labor contribution but also with the achievements of those who work alongside them. For example, excellent production indices have been achieved by the workforces of the departments, shops, brigades, and sections headed by party members I. Anokhin, P. Poddubnyy, V. Sannikov, G. Leonov, and V. Stakanov.

People of differing age and life experience work at the enterprise. A substantial contribution toward production growth is being made by labor veterans M. Zudilin, F. Farnashev, B. Kuz'min, N. Yegunov, and V. Dubovitskiy. And of course veterans of the Great Patriotic War march in the front ranks of

the competitors. They include installer M. Stepanov, radio benchman V. Orlov, and benchworker-mechanic N. Popov.

"We veterans feel a particular sense of responsibility to our comrades who did not return from the war and to the entire people," they say. "This labor watch in memory of the war will be our contribution toward strengthening the combat readiness of the glorious Air Forces and our country's defense might." Their example is being followed by Komsomol leader Engr V. Shirokov, benchworker-mechanic B. Sharov, radio benchman S. Orlov, and installer A. Trishkin. All of them are united on the labor watch by a feeling of love for the homeland, pride in it, and a special feeling of involvement in a great feat by the Soviet people. This is truly a school of patriotic and moral/ethical indoctrination for the young workers, who know of the terrible days of the past war only from the stories told by their elders. Production successes will be the finest remembrance of those who died and will show that today as well there is a place for exploits -- labor exploits.

The effect generated by the shock-work labor by those taking part in the labor watch will enable the enterprise to complete the year's plan ahead of schedule -- by 28 December. By year's end savings will total up to 20,000 cubic meters of natural gas and up to 15,000 kilowatt hours of electricity. It is projected that labor productivity will rise an additional 1.5 percent. The results of these past shock-work weeks have laid down an excellent foundation for achieving the targeted performance levels.

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#### GOOD POLITICAL OFFICER PROCEDURES OUTLINED

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 11, Nov 84 (signed to press 3 Oct 84) p 8

[Article, published under the heading "Warriors of the Ideological Front," by Maj V. Paramonov: "By Word and Deed"]

[Text] I met political section propagandist Maj A. Fominykh at a training conference for ideological workers. We sat next to one another during the presentations, and we conversed during the breaks. Aleksandr Aleksandrovich told me about the problems which concerned him and shared his thoughts about improving the quality of ideological and political indoctrination work. The logic and clarity of his views and the well-reasoned nature and convincingness of his conclusions aroused my interest in my interlocutor. I could not help but recall that, in describing Major Fominykh, his superiors emphasized these qualities.

In his presentation at the training conference Aleksandr Aleksandrovich described the work activities of the agitation and propaganda team and told how its members are raising the ideological-theoretical and methodological level of the lectures they prepare. When discussing advanced know-how, he cited specific and instructive examples.

There was a time when some members of the agitation and propaganda team did not take much trouble about preparing for their next lecture and did not consider it necessary to do solid work on updating the material of a familiar topic and to select fresh examples from the daily affairs of the subunits. Aleksandr Aleksandrovich recalled an instance when one of the officers asked him for a ready-to-present lecture so that he could use it in his presentation.

"If I start from scratch, I will lose a lot of time," the officer stated in self-justification, "while you have everything worked out already. I shall merely add examples!"

"You will lose time?" queried Fominykh, scrutinizing his interlocutor. "The loss will be considerably greater if you pay excessive attention to form with consequent detriment to content in your presentation, if you present other people's ideas to your audience. I am always ready and willing, however, to



help you prepare for a lecture. Drop in. We shall prepare a lecture outline and select literature."

Major Fominykh kept his promise. As a result the lecture prepared by the officer received high marks from the agitation and propaganda team members who reviewed it. But Aleksandr Aleksandrovich did not leave it at that. He attended the officer's class, made a detailed critique of the lecture, noted positive points and certain shortcomings, and advised him to visit the classes of experienced leader personnel. And gradually things improved.

One could cite many examples where Major Fominykh helped in the development of volunteer propagandists. The group in which classes in Marxist-Leninist training were conducted by officer N. Lesnikov was considered a lagging performer in the technical maintenance unit. Aleksandr Aleksandrovich visited the group once or twice and talked with the instructor and students. And he came to the conclusion that Lesnikov was conscientious about preparing for classes, did a thorough job of selecting material, and tied in points of theory with practical tasks. But he did not keep a sufficiently close eye on the students' independent study, did not always assist lagging personnel in a prompt and timely manner, and did not offer recommendations on preparing for seminars. The propagandist advised the officer to correct these deficiencies.

Some time later the success rate had noticeably improved. And the group received a mark of excellent at the final seminar for the term of study. The officers had succeeded in gaining their men's interest in increasing their ideological-theoretical knowledge. As a result the majority of the subunit's political instruction groups received performance testing marks of good and excellent. Technical maintenance unit personnel also successfully accomplished production targets and fully met socialist pledges.

But how does the political section propagandist himself prepare for lectures and how does he take into consideration the demands of the 26th CPSU Congress and the June (1983) CPSU Central Committee Plenum? First of all Aleksandr Aleksandrovich works with appropriate literature and periodicals. For example, in preparing a presentation on improving Soviet democracy and the entire political system of the Soviet society, he utilized the speech by CPSU Central Committee General Secretary Comrade K. U. Chernenko at the April (1984) CPSU Central Committee Plenum, the CPSU Central Committee decree entitled "On Further Improving the Work of the Soviets of People's Deputies," the proceedings of the First Session of the USSR Supreme Soviet, 11th Convocation, as well as articles on this topic appearing in the central newspapers and magazines. Carefully selecting material for his lecture, the author took pains to demonstrate through convincing comparison the development of genuine democracy in our country and its limited, lip-service nature in the bourgeois parliaments.

We should note that in the course of preparing for lectures and presentations Major Fominykh thoroughly studies and analyzes the writings of the founders of Marxism-Leninism, the proceedings of the 26th CPSU Congress, plenum decisions and party Central Committee decrees, the tasks of and advanced know-how in ideological work. Impressive figures, persuasive comparisons, the apt proverb or saying, and the vivid artistic image are indispensable in lectures.

Aleksandr Aleksandrovich finds meaty definitions, examples, and historical analogies in reference books, dictionaries, and specialized literature. He also utilizes the techniques of orators of the Lenin school. This helps him give his lectures a problem-addressing character, helps free them of trite cliches, copybook truths, and ponderous turns of speech, and helps introduce the students to lively theoretical thought. This is Major Fominykh's goal in preparing a lecture. But what is the goal of the presentation proper?

"To mobilize the men's intellectual energy, to boost their job-performance activeness in order to accomplish their assigned tasks," the propagandist replies.

This goal is the basis of all his activities.

...Aviation personnel were preparing for a tactical air exercise, in the course of which they would be redeploying to an alternate airfield, from which they would fly missions in support of advancing ground troops. Just prior to commencement of the exercise Major Fominykh visited this outfit, spoke with the men, and helped party activists prepare materials for discussions on the military-political situation in the world and in the given region, about the aggressive nature of imperialism and increasing the vigilance of military personnel.

The young pilots who were taking part in their first tactical air exercise were a focus of particular concern by the propagandist. Appraising their moral-psychological state, he reached the conclusion that on the whole the combat pilots had prepared well, but nevertheless some of them were excessively nervous. For several years now Aleksandr Aleksandrovich has been a member of the unit methods council in the moral-psychological training section. He knows from experience that at such a moment young aviation personnel are particularly in need of moral support, and therefore he thoroughly thought through the topics of his presentations to the young men and prepared appropriate material.

After determining in detail the state of affairs on the spot, Major Fominykh presented his suggestions to the squadron commander and the party activists. It was decided to conduct a number of measures with the young pilots and to mobilize them for successful performance of the missions of the tactical air exercise. For example, in the discussion presented by squadron executive officer Maj V. Kozhevnikov, he reminded them of the importance of precision actions at all phases of a sortie. Other combat experts shared their experience and know-how in working at various exercises and warned the young men against possible mistakes. Volunteer propagandists officers A. Solodnikov, Ye. Tiunov, N. Ustinov, and others held political briefings and discussions on a regular basis, in which, following the recommendation of Major Fominykh, they related exploits performed by Soviet pilots during the Great Patriotic War, talked about the succession of generations, revealed the anti-Soviet, antisocialist directional thrust of the aggressive blocs of imperialist nations, and called for vigilance and discipline.

During the period of preparation and in the course of the tactical air exercise Aleksandr Aleksandrovich and the squadron political worker gave daily

briefings to ideological activists, presented talks to the men, ensured delivery of the latest newspapers, and took pains to ensure that personnel had the opportunity regularly to hear the latest news over all-union radio, were fed at the proper times, and spent their off-duty time in an interesting manner.

Aviation personnel successfully accomplished the tasks of the tactical air exercise. Some of the credit for this goes to Maj A. Fominykh.

The range of the propagandist's activities is broad indeed. And he is always among the men, in the thick of things, ready and willing at all times to teach, to prompt, and to assist by word and deed.

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## TRAINING HELICOPTER SQUADRON FLIGHT TECHNICIANS

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 11, Nov 84 (signed to press 3 Oct 84) p 10

[Article, published under the heading "Constant Attention to Flight Safety," by flight technician-instructor, master-rated Capt V. Bozhko: "A Flight Technician-Instructor Is Not a Passenger"]

[Text] The silence of the night was interrupted from time to time by the whistling sound of turbines building up rpm. Helicopters were taking off one after the other. Unoccupied ground maintenance technicians and flight technician-instructors gradually gathered under the awning of the flight-line shelter. One of them said: "I just got reprimanded by the squadron engineer. Why, he asks, has it been so long since you have been up to check the performance of the flight technicians? Why waste time going up with them? There have been no complaints, and therefore things are going just fine. After all, they are not pilots, whose every action must be monitored...."

The fact is that the flight technician himself preflights the helicopter, performing all categories of inspection and other procedures. In the air the flight technician, as a member of the aircrew, monitors the operation of the powerplants, systems and equipment. During a flight he does not simply sit there like a bump on a log. Naturally flight safety depends in large measure on his job proficiency. Many do an excellent job of handling their duties. Nevertheless this conversation, which I heard by chance, surprised me. It recalled a past incident.

...The helicopter crew which included flight technician WO I. Minzhurov was to go up on an instrument flight under the IFR windshield hood. Upon reaching the practice area, the aircraft commander instructed Minzhurov to place the hood over the cockpit glass and prepared to fly on instruments. The flight technician, however, failed to accomplish even this seemingly very simple operation: he lacked the required skills. As a consequence the training flight failed to accomplish the objectives.

At first glance Minzhurov alone was to blame for what had happened. But I was unable to shake this feeling that I shared the blame. The warrant officer performed poorly due to ignorance and lack of skill. But I, as a flight technician-instructor, should have taught him correctly to handle the cockpit



gear. After that training sortie I conducted an expanded practice drill with him, and we filled in the gaps in his knowledge. I was left with a bad aftertaste, however, for this could have been done at an earlier time.

In the final analysis I made a pledge to myself: before scheduling a check flight with anybody, I would thoroughly test his level of proficiency on the ground. As practical experience showed, this approach produces good results. Flight technicians made far fewer mistakes in the air.

Sr Lt V. Mysak is a specialist with considerable experience and solid knowledge. But he had not been in the air for quite some time, and therefore we decided to hold a practice drill with him as he was preparing to go up. And this proved to be a good idea. He had lost some of his flight technician skills. A thorough on-the-ground rehearsal of procedures stood him in good stead. In the air Mysak performed flawlessly. Incidentally, such drill sessions benefit not only the person being checked out but the instructor as well: as you teach, you yourself learn.

Instructors should devote particular attention to young flight technicians and those who are retraining over to a helicopter of a different type. In our squadron, for example, we work with them according to the following principle: do as I do. During immediate preflight preparations we accompany the trainees on a preflight inspection of the helicopter, as procedures require. We check their knowledge of the operation of the various systems and equipment. This is essential in order to teach the specialists knowledgeably to analyze the causes of possible malfunctions and to correct them quickly. We then proceed from theory to practice. We always include a practice drill in the cockpit, including firing up the engines. In the process of this drill the instructors introduce a great many scenario instructions. Thus they learn to perform quickly, knowledgeably, and with composure in any situation.

The job of a flight technician-instructor is a busy one, for he must not only service his own helicopter and fly with it, but he must teach others as well. It is very important to have the ability properly to distribute one's work time and to plan one's actions. The problem lies here, I believe. Our district's air forces have prepared a special manual to train flight technicians, in which an instructor's duties are clearly spelled out. One need only read it and study the procedures involved. Some people, however, do not know how to organize their work correctly.

One can compensate for this deficiency with well-arranged training, and with instructor training conferences, as flight personnel do. Having gone through the requisite course of theoretical and practical training, the flight technician-instructor, when he climbs aboard a helicopter, will feel not like a passenger but like a genuine teacher.

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## FIGHTER-BOMBERS FLY ROUTINE TRAINING SORTIES

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 11, Nov 84 (signed to press 3 Oct 84) p 12

[Article, published under the heading "Be Alert, In a Continuous State of Combat Readiness," by Maj V. Shestachenko: "On Flight Operations Day"]

[Text] The air was shattered by the thundering afterburners of the powerful engines. The fighter-bombers were taking off, one pair after the other, and heading out on a mission. The sharp "eyes" of the radars followed them. Precise, concise commands were transmitted from the command post to the aircraft. On the ground the maintenance specialists were continuing to ready aircraft for the next sorties. On a day of intensive flight operations at the concluding stage of the training year everybody has plenty to do. And each person labors at full effort at his work station, endeavoring to accomplish the assigned task as well as possible and to achieve new performance levels in socialist competition.

That morning the ground maintenance specialists had been the first to arrive at the airfield. A great deal had to be done prior to commencement of flight operations. Flight technical maintenance unit chief Gds Capt M. Gilyazov had long since become accustomed to greeting dawn at the airfield. He walked with long strides along the resonant concrete slabs, taking in deep breaths of fresh air and listening to the ringing silence of the early morning.

Inspecting the aircraft, Gilyazov did not miss a single item. He carefully checked hinge gaps, tightening and retaining of bolts, nuts, parts and assemblies. Proceeding from one aircraft to the next, he jotted down comments in his notebook, in order later to check to determine how discovered problems had been corrected.

The team he leads is rated excellent. The flight's fighter-bombers are always in a combat-ready state and are maintained in exemplary fashion. Time and again during his years in the service party member Gilyazov has spotted various malfunctions in time, has quickly corrected them and thus prevented the preconditions for an air mishap from occurring. This attests to the officer's high degree of job proficiency.

The socialist pledges of the flight's aviators include, in addition to others, such points as high-quality servicing of aircraft during flight operations, mutual interchangeability, increasing proficiency rating and improving technical knowledgeability, and concern for properly maintaining the flight line positions. Incidentally, things are set up here in such a manner that equipment removed from an aircraft as well as requisite ground equipment and tools are always close at hand. And this saves a great deal of time in readying the fighter-bombers for a training sortie.

The specialist personnel of the weapons group headed by Gds Sr Lt V. Pirozhkov have done a good job. They perform all operations conscientiously. Aircraft equipment mechanic Gds Pfc V. Abramovich and specialized vehicle driver Pvt S. Gerasimov did a good job. The men realize that reliability and failure-free operation of aircraft systems depend on the smooth, coordinated efforts of the entire team, and therefore they put their hearts into their work. The pilots have faith in them, just as they have faith in themselves. And there is nothing unusual about this. This is the way an aircraft maintenance specialist's job is.

...The time was approaching for flight operations to begin. Green flares shot skyward. The pointed-nose aircraft taxied out to the active precisely on schedule. Gds Capt V. Shalygin was also preparing to put his fighter-bomber into the air.

"This is 305, ready for takeoff," he radioed the tower.

Receiving takeoff clearance, the pilot advanced the throttle to takeoff rpm. He started the stopwatch, and lit the afterburner. The aircraft proceeded to pick up speed. Another instant -- and it was airborne.

Guards Captain Shalygin has flown important missions day and night, in the foulest weather. In socialist competition he earned the title of top gun against ground targets. His comrades are well aware of how sharp and accurate his eye is. They also know that he always selflessly shares with his comrades the experience and know-how he has acquired. The guards outfit is strong precisely in such individuals. The men in this outfit watch each other's successes with interest and thoroughly analyze each and every flight. Competition results are regularly presented in visual agitation materials placed on a special display stand. They persuasively attest to the fact that victory in today's combat will be won by he who is not only bold and resolute, tactically knowledgeable, and capable of employing his weapons with maximum effectiveness, but also who knows his aircraft in every detail and makes full use of its maneuver capabilities.

On this day Gds Capt V. Shalygin and his fighting comrades flew repeated training sorties, practicing various mock combat missions. In their daily routine training they forge their professional skill and strengthen the outfit's combat readiness.

Things were bustling in the control tower. Flight operations officer Gds Lt Col V. Tolokonnikov was responding immediately to radioed queries and issuing commands with clarity and precision, while maintaining visual watch on the

runway and approaches. He was ready instantly to come to the aid of a pilot who had any problems with his landing approach.

"This is 315, outer marker inbound...", came the voice of Gds Capt V. Bakhmutov.

From the tower one had a clear view of the aircraft approaching the runway threshold with precision and flaring into the accustomed nose-up attitude. Bluish puffs of smoke were emitted by the wheel-runway contact. An instant later the drag chute appeared as an orange flash.

The tower controller issues a great many different commands in the course of a flight operations shift. The main thing in his job is concern for flight safety. Gds Lt Col V. Tolokonnikov is extremely conscientious about his job. He enters the necessary comments in his log, which later will be used in critiquing various pilot actions and in analyzing mistakes and errors. On the basis of these records it will be possible to give expert advice on correcting them.

The control tower is equipped with the latest technology. And of course it would be difficult for the flight operations officer alone to handle the large flow of information. He is assisted by the officers of the air traffic control team. It is precisely their smooth functioning, precise teamwork and coordination which in the final analysis determines flight operations safety. They have the ability correctly to assess a situation and to respond quickly and resolutely to new situation information. One can scarcely exaggerate their role in training and indoctrination of skilled pilots. The success of the guards outfit is born and the combat readiness of the crews and subunits grows in precise execution of his duties by each and every aviator and in close teamwork and cooperation.

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## CHANGES IN THIRD-GENERATION FIGHTER TACTICS CONSIDERED

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 11, Nov 84 (signed to press 3 Oct 84) pp 13-15

[Article, published under the heading "Tactics and Simulation," by Military Pilot 1st Class Col Yu. Kislyakov and Col V. Dubrov: "New Features of Air Combat"; part three of a four-part article (see AVIATSIYA I KOSMONAVTIKA No 9, 10, 1984)]

[Text] The results of fighter combat actions in large and small wars in which new aircraft for the time were employed indicate that the level of losses (ratio of number of downed aircraft to number of engagements fought) has gradually risen. Adversaries engaging in air combat would increasingly less frequently return to their base in full numbers. Increase in the kill effectiveness of air engagements led in the final analysis to more rapid exhaustion of the assets of the opposing sides as well as to a decrease in the duration of combat actions in the air (in particular, due to an overall decrease in the size of air forces' aircraft inventory in connection with a sharp increase in the cost of building aircraft). "Survivability of the tactical aircraft has become one of the fundamental problems in accomplishing a combat mission," stated the magazine AVIATION WEEK.

An analysis performed by foreign experts reveals the principal factors which contributed to a decline of survivability of fighters in a combat environment. Following are the principal factors: growing weapons capability, weakness of protection, and inadequate aircrew proficiency.

According to established views, the "weapons" factor is determining in the evolution of air combat and in devising modes of its conduct. Fighter effective weapons capabilities had grown quite rapidly in the 30 years since the war, whereby new air-to-air weapons had joined older ones. Short-range and subsequently medium-range missiles sequentially joined the aircraft cannon. For example, the third-generation F-15 fighter carried the entire weapons package enumerated above, which the pilot utilized according to circumstances -- in highly maneuverable close-range combat or in all-aspect medium-range combat.

Increased capabilities to detect the adversary at a great distance and the increased weapons accuracy and power could not help but affect aircraft



vulnerability (loss ratio). Essentially it became simpler for a fighter to attack than to repulse an attack.

Specialists consider weakness of defense to be the second most important factor affecting effectiveness of air combat (a rise in the aircraft loss ratio). This applies in equal measure to hardware and tactics.

Past experience indicates that the side taking a defensive stance in combat has not always sustained heavy losses. Suffice it to recall the combat record of the North Korean fighters which were defending their airspace against mass incursions by the U.S. aggressors. At that time deficiency in fighter defense was not yet being advanced as a serious problem. Offensive tactics, which called for an aircraft to enter a limited and mobile region of weapons employment were countered by tactics of evasion. In conformity with the notions of World War II, emphasis was placed on "pilot-maneuvering" aircraft. And if the pilot being attacked spotted his adversary in time (the element of surprise was neutralized), he could avoid the threat by skilled maneuver. Turn radius was commensurate with cannon fire range, and aircraft speeds differed little (the North Korean MiG-15 was superior to the U.S. Saber in thrust-to-weight ratio and in firepower).

The situation was somewhat different in air warfare in Vietnam. Military experts defined the principal change as follows: the offensive potential (lethal capabilities) of supersonic fighters had increased considerably due to the use of guided weapons, while the defense had acquired nothing other than additional speed. The North Vietnamese MiG-21 fighter was armed with missiles, as was the U.S. Phantom. "Breakaway" tactics proved unsuccessful; the MiGs more frequently won the final stage (disengagement). Maneuver remained the most effective method of defense. But the Phantom -- the principal U.S. Air Force second-generation tactical fighter -- had an excessive wing loading, in line with the prevailing notions of the time. With a specific wing loading of 490 kg/sq m, it was unable to execute evasive maneuvers (the MiG-21, with approximately equal thrust-to-weight ratio, had a specific wing loading of 340 kg/sq m), which directly reflected in air combat losses.

Local wars revealed the vulnerability of combat formations, especially during direct escort of strike groups. The loss ratio would be highest precisely during performance of this mission. Gaps would open up in the defensive formations, into which interceptors would penetrate and attack the bombers. And protection of the escort fighters was weakened due to the limitations of group maneuver.

A variation whereby tactical fighters and bombers are employed jointly within the framework of a common combat mission but with strict delineation of actions by time and point in conformity with the strike plan is considered more preferable at the present time. In tactics this means elimination of a common (composite) formation while maintaining fighter responsibility for safety of the bombers.

Strengthening protection of the fighters proper is connected with ensuring undetected flight and elimination of giveaway signs. As was already noted,

air combat at medium ranges is considered "instrument combat," since detection and identification of, closing with, and attack on the adversary are performed on the basis of radar data or information from other sensitive detection and aiming devices. In the course of radar search, which provides the greatest range of airspace surveillance, the pilot obtains information on hostile aircraft from a return on his screen. The smaller the target's radar cross section, the later it is detected. Therefore efforts are being made artificially to reduce an aircraft's radar cross section (the greatest reflection is produced by air intakes, dish antenna located in the nose fairing, and cockpit canopy -- when radar-painted from the front; wing-fuselage joints, tail assembly, and external ordnance-mount pylons -- when radar-painted from abeam). The weaker the reflected signal, the smaller the advantages of radar-guided medium-range weapons. This "inconspicuousness," however, is possible only until such time as emitting devices are switched on, such as radar sight in search and lock-on mode.

It is proposed that intensity of thermal emissions be reduced by utilizing flattened exhaust nozzles with active cooling of the hottest surface areas. In combat this means that the target lock-on range of a heat-seeking air-to-air missile would decrease. Foreign experts also believe that a laser emitter which aims at a heat-seeking missile appearing in the threat zone to be a promising means of protection. As reported by the magazine AVIATION WEEK, 13 AIM-9 Sidewinder missiles were fired during testing of an experimental model of a laser intercept system. Five missiles were locked into tracking during flight above a test range and "killed" with a 400 kilowatt laser ("kill" is defined as forcing a missile to deviate from its homing path).

The magazine FLIGHT stated: "Air combat has become even more complex due to increased weapon range. Loss of surveillance contact with the adversary at a distance of less than 20 km can be considered a portent of defeat, while several years ago this was not of great importance. Therefore electronics should come to the fighter pilot's aid."

At the present time foreign fighters are equipped with radar warning systems, as well as with sensors to detect missile command guidance signals and to determine direction to a source of emissions with the aim of neutralizing it. Warning devices are mounted inside the fuselage, while active jamming sources are mounted on external pylons. Tests have shown that exterior pylons carrying ECM gear increase drag and worsen an aircraft's flight performance by as much as 50 percent. Experts believe, however, that in conditions of rapid development of search systems and increased-range weapons, the future in fighter tactics belongs to ECM hardware and techniques. This is also confirmed in part by the experience of air combat over Lebanon during the June 1982 conflict.

As was noted by the magazine AVIATION WEEK, active threat neutralization systems and means of self-protection which delude the adversary are very costly and are not always reliable. Their effectiveness depends on accuracy of information on the nature of the threat and instantaneous selection of a countermeasures signal. It is believed, for example, that during missile tracking and guidance the attacker can utilize an additional simulation

emitter, which will activate individual protection devices and will give the defender the false impression that his aircraft is invulnerable. Three principal kinds of fighter defense in air combat have been specified for the near future: evasive maneuver (aircraft withdrawal from the zone of potential attack), employment of weapons (including laser) against released ordnance, and utilization of ECM.

In addition to fighters, ground-attack aircraft and helicopters fight defensive air combat (for the most part during daylight in VFR conditions). Infrared jamming transmitters and "decoys" (infrared tracers) as well as devices to reduce thermal emission are employed to protect them against heat-seeking missiles. For example, all overseas-based U.S. aircraft carry a paint job which reflects 7 percent of solar energy (paint usually reflects as much as 60 percent). The Israeli AH-1G Huey Cobra helicopter (purchased from the United States) carries a radar illumination warning system, and engine exhaust is directed upward (to make it more difficult for a heat-seeking missile to lock onto the "flare" when closing from abeam and when fired from below).

A third factor which has contributed to reduced fighter survivability in air combat is a poor level of flight personnel proficiency training. During World War II and the war in Korea military pilots differed both in level of training and in specific job skills: fighter pilot, ground-attack pilot, bomber pilot. Aircraft also were specialized, and their performance characteristics conformed strictly to the conditions of performance of their principal missions. A fighter pilot flew an aircraft designed to fight air-to-air. He might be called upon to provide close air support, to seal off the tactical area of operations, and to conduct air reconnaissance, but he conducted air-to-air combat in a professional manner. Combat was the leading element in training flight personnel and in fighter tactics. All other components were subordinate.

In the course of the war fighter aces -- experts at air-to-air combat -- stood out above the rest of flight personnel. Their combat totals were exceptional. AIR FORCE MAGAZINE reported, for example, that 80 percent of the total number of aircraft downed in combat were credited to 20 percent of the pilots. It was also noted that the fighter aces possess a natural gift in addition to excellent flying proficiency, are blessed with extremely fast reactions and a more acutely aware sense of position during complex air combat maneuvering.

Following the war in Korea the idea of a multirole tactical aircraft was implemented in the military of the Western countries with the development of weapons of mass destruction. In addition to "high-speed penetration" capabilities, an attractive idea was the capability to operate with equal effectiveness against both air and ground targets. The economic benefit also seemed obvious: there would occur standardization of manufacture, logistic support, technical services, command and control, and training of flight personnel. This tempting peacetime notion, however, lasted only to the beginning of the next war, unleashed by the imperialists in Southeast Asia. They had succeeded in making the aircraft multirole, but not the pilot.

Lt Col R. Hahn, pilot of a multirole Phantom, writing in AIR FORCE MAGAZINE, does the best job of explaining the reasons for the failure of these off-track



theories. It was unwise to assign the fighter an additional function -- delivery of air-to-ground weapons to strike objectives. First of all because it was necessary to beef up the wing and fuselage construction in order to withstand the load of externally-mounted ordnance. Additional tons had to be carried in performing each mission: both that of bomber and that of fighter. This had an adverse effect on maneuverability, which is so essential in air-to-air combat. Secondly, downing airborne hostile aircraft (especially attack aircraft, which carry the greatest threat to defended installations) is of itself a considerable mission, handled by a separate air component and by a special aircraft. Thirdly, the great number of combat missions, diversity of armament, complexity of equipment, and diversity of tactics inevitably lead to a decline in the pilot's performance skills. As experience indicates, "jacks-of-all-trades" in flying usually have only an average level of training proficiency. We quote him: "If we compare the Korean War, when pilot training was specialized, with the war in Vietnam, where combat was being waged by fighter pilots trained for multirole application, it is obvious that relative losses almost tripled."

Was there a "savings" with sharply increased losses? U.S. experts remain silent on this score. It is a fact, however, that the multirole Phantoms were subsequently totally shifted over to flying "strike operations." And specialized fighters, optimized to fight high-maneuver air-to-air combat, appeared in the tactical air arsenal in the mid-1970's.

U.S.-built Israeli-F-15 and F-16 fighters were not employed as bombers in the most recent conflict in the Near East. Pilots flew the highly-specific missions for which they were trained. Phantoms, Kfirs, as well as Skyhawk attack aircraft flew against targets in Lebanon. Nevertheless the notion of a tactical aircraft with "many qualities" is stubbornly holding its ground. The dual-role F-15 (fighter modification), for example, with its wing area unchanged, now weighed 32 tons instead of 20. The European-built multirole Tornado, which comes in an interceptor and a fighter-bomber version, has also been given a higher wing loading. Different equipment and ordnance are carried by an identical airframe and engine, and these aircraft have a common trait -- a high wing loading, which impedes combat maneuver.

Sociological studies conducted abroad have indicated that during World War II pilots did not avoid combat when there was a success probability of 0.3-0.4. They would take considerable risk if they could inflict appreciable damage on the adversary. Manifest doubt and lack of confidence would develop in a fighter pilot, however, if his aircraft showed a poor degree of tactical reliability, that is, if it failed to conform even in part to the conditions of execution of the principal combat mission. This feeling is natural, and therefore it endures. The magazine AVIATION AND MARINE INTERNATIONAL, for example, noted that the pilot of a modern F-14 carrier-based fighter can successfully perform long-range intercept and can seal off a combat zone (utilizing the aircraft as a fighter-bomber), but in high-maneuver air-to-air combat the pilot feels uncertainty due to the aircraft's poor thrust-to-weight ratio and high wing loading. Instead of tested and proven tactics combining fire and maneuver, which directly affect success in combat, he emphasizes tactics of preventing the adversary from closing from long range, tactics which depend more on the capabilities of the aircraft's electronics and their



resistance to jamming than on the skill of the aircrew (on the F-14 the pilot is assisted by a backseat weapons officer).

In the opinion of foreign experts, factors which are "hidden from external observation" are not always correctly considered in assessing the results of air combat between supersonic fighters. These include the pilot's intellect and his ability to make sound decisions in an unconventional situation. AIR FORCE MAGAZINE states in this regard: "It is important to remember that the pilot is a component part of the fighter aircraft system. An aircraft may possess outstanding capabilities, but they are utilized precisely in the degree to which the pilot's level of proficiency and experience permit."

Unfortunately it is currently in fashion -- a fashion of unknown authorship -- frequently to view the pilot as a system operator, who receives a flow of control information and unthinkingly executes received commands. The role of a transmission mechanism allegedly frees the pilot's thought process from an excessive work load "in extreme conditions." In practice the bitter fruits of such delusions have been reaped not by their authors but executors. U.S. pilots in Vietnam, for example, who were accustomed to obey commands but who frequently operated out of information contact, proved unprepared to handle combat with unexpected "scenario changes."

Of course automation has freed man of many processes connected with immediate reaction and control, but it has not freed him of the need to think. It has not diminished but has increased demands on the pilot's intellect. The cockpit of a modern aircraft does not house a robot but a man, with his inherent ability to foresee and capability to plan his actions in diversified air combat.

As a rule incorrect conclusions from analysis of a dynamic situation have led to decisions which failed to conform to the conditions of combat. The theory of "push-button warfare," which had become too predominant in fighter tactics, led to casualties which could have been avoided. Air combat continued to be a contest of minds; the assigned combat mission was performed by a pilot with the aid of a machine, but under no circumstances did a machine accomplish the mission with the assistance of the pilot. (To be concluded)

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## SOVIET SPACE PROGRAM COOPERATION WITH OTHER COUNTRIES

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 11, Nov 84 (signed to press 3 Oct 84) pp 21-22

[Article, published under the heading "Peaceful Orbits Above the Planet," by V. Yegorov: "For the Good of Mankind"; concluding part of two-part article, see AVIATSIYA I KOSMONAVTIKA, No 10, 1984]

[Text] The Soviet Union cooperates in the field of space exploration and research not only with the socialist countries. At the end of the 1960's India commenced to set up a national program of research and utilization of space. One of the areas of this program was the designing and building of India's own satellites. India asked the Soviet Union to help in designing and building the first Indian satellite and to lift it into orbit with a Soviet booster. An agreement between the USSR Academy of Sciences and the Indian Space Research Organization (ISRO) was signed in Moscow on 10 May 1972 for the purpose of accomplishing this task. The agreement specified that Soviet specialists would give scientific and technical assistance to India in designing a satellite, its service systems and scientific equipment, as well as in building in India a ground satellite monitoring and control facility.

On 19 April 1975 a Soviet booster lifted into precise orbit the first Indian scientific satellite, which was given the name Ariabata in honor of a famous Indian scientist. The satellite carried scientific apparatus to study the sun, sources of cosmic X-radiation, and the Earth's ionosphere. The launch of the Ariabata was an important step in the development of India's national science and technology. In designing and building the first satellite, Indian specialists were not only preparing scientific experiments but also performing a much more important task -- they were laying down the foundation of an Indian space industry.

An agreement between the USSR Academy of Sciences and ISRO was signed in Moscow in 1975, calling for the launching of a second Indian satellite from the Soviet launch facility, a satellite designed to study the Earth's surface from space. Just as the Ariabata satellite, it was designed and built with the active participation of Soviet specialists.

The second Indian satellite (named Bhaskara in honor of two famous Indian scientists of the 6th and 7th centuries) was lifted into a precise orbit by a

Soviet booster on 7 June 1979. More than 1,000 images of the Earth's surface were taken in the course of the experiments. The Bhaskara satellite marked the beginning of a program devised by Indian scientists which involved remote sensing of Indian territory and the ocean, with the obtained information to be used for the benefit of various branches and sectors of the nation's economy.

An agreement between the USSR Academy of Sciences and ISRO, calling for the launching of a third Indian satellite -- Bhaskara 2 -- was signed in Moscow on 11 June 1979. It was agreed that, just as in the launching of the first two satellites, scientific and technical results of the work performed within the framework of the joint project would be made accessible to the parties to the agreement. According to the agreement, this information was made available to the world scientific community. The Bhaskara 2 satellite was boosted into precise orbit on 20 November 1981.

Soviet-Indian cooperation in space research, in addition to the designing, building, and launching of Indian scientific satellites, is also taking place in the field of meteorology, study of lunar soil samples, astronomy outside the Earth's atmosphere, and satellite observations in the fields of geodesy, geodynamics, and study of the structure of the Earth's upper atmosphere.

The manned mission by an international Soviet-Indian crew on board the Soviet Soyuz T-11 spacecraft and Salyut 7 orbital station was an event of enormous significance. The Soviet-Indian international crew, consisting of spacecraft commander Pilot-Cosmonaut USSR Yu. Malyshev, flight engineer Pilot-Cosmonaut USSR G. Strekalov, and Cosmonaut-Researcher R. Sharma, a citizen of the Republic of India, rode into orbit from the Baykonur launch facility on 3 April 1984. The mission included eight experiments: six in space medicine, one industrial, and one experiment in remote Earth sensing for the purpose of studying India's natural resources. During a televised communications session with the spacecraft crew, Indian Prime Minister Indira Gandhi said to Rakesh Sharma: "Your flight is a historic event, and I hope that it will engender in our country a feeling of participation in the exploration and conquest of space and will provide encouragement to our young people."

France was the first capitalist country with which the Soviet Union signed an intergovernmental agreement on cooperation in the study and exploration of space (30 June 1966 in Moscow). A large number of experiments were conducted after that, involving virtually all the principal areas of space research. We might cite as an example the Stereo-1 experiment (carried on board the Soviet Mars 3 interplanetary probe), to study solar radiation bursts of various types in the plane of the ecliptic, the Neige-1 experiment (on board the Soviet Prognoz 2 satellite) to study solar gamma radiation, investigations of solar motions with the aid of French laser reflectors (placed on the lunar surface by the Soviet Lunokhod 1 in November 1970 and Lunokhod 2 in January 1973), investigations of the effects of cosmic radiation and weightlessness on a living organism as part of the research conducted on board Cosmos series biological satellites and on board manned spacecraft (the Salyut orbital station).

In the unanimous opinion of scientists and government officials of both countries, cooperation between the USSR and France in the field of space

research is progressing very successfully and is making a substantial contribution both toward the development of world space science and toward the cause of strengthening friendly relations between countries.

This was reconfirmed by the joint Soviet-French manned mission, with a crew consisting of Pilot-Cosmonaut USSR V. Dzhanibekov, Pilot-Cosmonaut USSR A. Ivanchenkov, and cosmonaut-researcher Jean-Louis Chretien, a citizen of the French Republic, on board the Salyut 7 - Soyuz T-5 - Soyuz T-6 orbital scientific research complex (24 June-2 July 1982). The scheduled scientific program drawn up by scientists and specialists from the Soviet Union and France was fully completed during this mission.

Experiments conducted during this mission evoked great interest on the part of the world scientific community. In particular, French scientists, who had prepared medical experiments and who processed experiment results, reported that the results obtained from conduct of the Echograph experiment (study of the functioning of a cosmonaut's cardiovascular system during sequential stages -- training, time spent in weightlessness, and readaptation) are unique in worldwide space research.

Organization of an international satellite search and rescue system for vessels and aircraft in distress -- KOSPAS-SARSAT (KOSPAS -- Kosmicheskaya sistema poiska avariynykh sudov [Space-Based Vessels in Distress Search System], SARSAT -- Search and Rescue Satellite) -- is a vivid example of effective international cooperation in the area of utilization of space in a most noble cause -- saving people's lives. It was developed jointly by Soviet, American, Canadian and French specialists.

At the very commencement of testing of the KOSPAS-SARSAT system, the Soviet Kosmos 1383 satellite became world-famous as a rescue satellite. The first persons rescued were three Canadians whose airplane had gone down in the mountains of Western Canada. And although the system is experimental for the time being and is in the testing stage, its utilization has made it possible in approximately 70 instances quickly to determine the location of ships in distress and downed aircraft and to assist survivors.

An improvement in Soviet-U.S. relations at the end of the 1960's and beginning of the 1970's made it possible to find areas of common interests in the scientific and practical aspects of space exploration, and particularly in the area of providing greater safety to manned missions. The upshot of this was the signing of an intergovernmental agreement between the USSR and the United States on 24 May 1972, entitled "On Cooperation in Research and Utilization of Space for Peaceful Purposes." The central item in this agreement was a mutual pledge to work on designing compatible means of approach and docking between Soviet and American spacecraft and stations, for the purpose of increasing the safety of manned space missions and providing the capability to conduct subsequent joint scientific experiments. In particular, the agreement called for conducting in 1975 a first experimental joint mission by a Soviet Soyuz spacecraft and a U.S. Apollo spacecraft, with approach, docking, and intercraft cosmonaut-astronaut exchange (the EPAS program).



The EPAS program, on which Soviet and U.S. scientists, engineers, and workers labored with determination for more than 3 years, was carried out in full. The correctness of the engineering solutions to ensure compatibility of the approach and docking hardware of future manned spacecraft and stations was tested and confirmed, as well as the soundness of selection of principles of coordination between Soviet and American ground services during mission control from two centers located on two different continents.

The peoples of the entire world placed high hopes on this first international experiment with the participation of manned spacecraft of the leading space powers, conducted in July 1975. Unfortunately these hopes failed to pan out. The U.S. policy of extensive military utilization of space, which was proclaimed at some time in the past, has today taken on a truly sinister character. On 23 March 1983 Reagan announced the development of "Star Wars" plans by the United States.

In contrast to the United States, the Soviet Union is doing everything possible to ensure that space remains free of weapons and does not become an area of military clashes, to ensure that a threat to the people living on Earth does not emanate from space.

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## SATELLITE REMOTE SENSING SERVES GEOLOGY

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 11, Nov 84 (signed to press 3 Oct 84) pp 22-23

[Interview with Doctor of Geological-Mineralogical Sciences V. Moralev, department head, USSR Academy of Sciences Lithosphere Institute, by AVIATSIYA I KOSMONAVTIKA special correspondent Col V. Gor'kov, published under the heading "Our Interviews": "The Space Program in the Service of Geology"]

[Text] In August our country warmly and cordially greeted some guests -- delegates to the 27th Session of the International Geological Congress (IGC). Representatives of more than 100 countries came to Moscow. The congress was convened in the Kremlin Palace of Congresses. Plenary and section meetings, colloquiums and symposiums were held over a period of 10 days. More than 2,000 papers were presented to the delegates.

Geologists' interests are unusually broad: from the internal structure of the Earth to the origin of the universe. Today even astronomers consult with these specialists. Our planet is full of as yet unsolved mysteries. Some of these secrets will be unraveled by geologists. For this reason they actively employ new research methods, instruments and equipment in their activities, including space hardware.

Our special correspondent, Col V. Gor'kov, met at the congress with Doctor of Geological-Mineralogical Sciences V. Moralev, department head at the USSR Academy of Sciences Lithosphere Institute, one of the chairmen of the section on remote sensing. We publish this interview below.

[Question] Remote methods of studying the Earth from space are widely used for the benefit of various branches and sectors of the economy and science. Tell us please, Valeriy Mikhaylovich, when geologists began utilizing these techniques and why.

[Answer] The history of the development and utilization of remote sensing techniques in geology dates from the 1930's, when the first experiment was conducted in aerial photography in our country's southern, open, as geologists

say, regions. It demonstrated that one could reduce the number of field routes without detriment to the quality and reliability of preparation of geological maps. Employment of aerial photography was mandatory in geologists' work from 1938 on. Remote methods experienced more extensive development in the postwar years, when specialized aerial geological survey expeditions were formed. The subsequent stage has involved utilization of satellite data. The first satellite imagery placed at the geologist's disposal indicated a great deal of promise. Specialists obtained images of the Earth's surface which had previously been unavailable. Because of their small scale, they encompass a large coverage area. This makes it possible to perform a structural analysis of large areas, that is, to identify linear elements, which have been given the name lineaments, and specific (practically unknown prior to satellite photography) features, so-called ring or oval-ring structures. Remote techniques experienced further development with the commencement of multiple-frequency-band imaging. They make it possible to obtain a fuller picture of the structure of the Earth's crust observed from altitude. The anticipated accomplishments of remote sensing were also demonstrated at the just-completed IGC meeting. The breadth of problems and examples of specific practical results earned our section a great deal of respect, since it was meeting for only the second time during the entire more than 100-year history of the IGC. I attended the Congress's 25th Session in Sidney in 1976. This section did not exist at that time. It was first established four years later at the 26th Session of the IGC in Paris. In Moscow representatives of 40 countries took part in the section proceedings, and more than 70 papers were presented. Why are remote techniques winning increasing recognition with each passing year? An increasingly more important role in the mineral resources balance sheet is played by hidden mineral deposits which are not detected on the Earth's surface by traditional methods. They are hidden under a concealing mantle of young ore-free sediments of various thickness. Remote sensing techniques are called upon to help remove this concealing screen.

[Question] You have touched upon an interesting question. How are the following problems linked: remote sensing, and prediction of mineral deposits?

[Answer] Sometimes journalists write that remote sensing has made it possible to "peer" into the Earth, into its lithosphere. Such statements became especially fashionable with the development of multiple-frequency-band imaging. Many readers take these words literally. I should note that they are in error. At the present time we know with absolute certainty only that there exists a certain relationship between the surface layer of the lithosphere and its deep structure. Accuracy of prediction of the latter depends to a considerable degree on knowledge of the former. Boreholes are sunk for the purpose of determining these relationships. The purpose of drilling is to interpret the materials obtained by geophysics, geochemistry, and remote sensing pertaining to deep sections within the Earth's crust. The Soviet Union has an ultradeep-drilling program; it is planned to drill more than 10 boreholes in various parts of the country. The experience of the 12-kilometer-deep Kola borehole indicated that in order successfully to select locations for such holes and in order successfully to utilize drilling results, it is essential to make a thorough study of the site areas, including a structural study, performed by interpreting remote sensing materials. In the future drilling will make it possible to verify the correctness of the

predictions we make today. Each hole drilled confirms or corrects current knowledge and makes it possible, utilizing the more accurate parameters obtained, to refine our interpretation of the initial materials, for structural analysis of the surface and geophysical data constitute the principal tool for predicting deep structure. Both contain errors. They can be reduced by work performed on these boreholes. And when errors are reduced to a minimum, we shall be able to state boldly that the depths of the Earth can be seen from space.

[Question] As we know, today geologists are interested not only in the Earth with its internal structure but the other planets of the solar system as well, Venus in particular. Could you tell us what was said at the congress in this regard?

[Answer] Imagery of the Venusian surface obtained by the Venera 15 and Venera 16 Soviet unmanned interplanetary probes was shown in our section. The pictures clearly showed volcanoes, craters, mountains, and ring-form uplifts. A profile of the Maxwell Range, for example, was recorded with the aid of an elevation-measuring instrument, as a consequence of which we can estimate mountain heights and slope steepness. We are interested in the nature of the craters. It is believed that they are of two origins: impact (from meteorite strikes) and volcanic. Some craters on Venus are clearly of volcanic origin. This is one of those problems which must be solved on Earth as well.

[Question] Valeriy Mikhaylovich, could you tell us to what extent theoretical premises have today been put to practical application? Can one say that following the experiments there has commenced a stage of return on investment, from those funds which were invested in development of remote sensing methods in geology?

[Answer] Without question. Although experimentation will not cease as long as geology continues to exist. To date there has been established in the Soviet Union a system of regional geological studies based on extensive utilization of remote sensing methods at various stages of the geologic process. This system includes space photogeological mapping, projects involving ground verification of imagery interpretation, geologic-mineragenetic mapping, geologic study of ultradeep-borehole site areas, and aerial photogeologic mapping. The abundance, fundamental newness, the nontraditional and frequently problem nature of features revealed in satellite imagery impelled us to commence preparation of special space photogeologic maps and combined projects to verify them in specific areas. Correspondingly two types of independent activities have taken form: space photogeologic mapping, and ground verification of satellite imagery interpretation results. The former is performed to prepare maps which reflect the structural features of the Earth's crust which were revealed in interpreting satellite imagery of various types and scale. Maps are prepared by analyzing geological and geophysical information and conducting ground and airborne visual observations to supplement and verify data on the substantial and structural characteristics of the features interpreted on the images. During interpretation principal attention is focused on identifying features not previously depicted on maps. Standard representatives of each type of feature being mapped are subjected to field study. Geological-content summary review



maps are prepared utilizing remote-sensing imagery materials. The 1:1,000,000 scale State Geologic Map of the USSR is being revised, a medium-scale fuller geologic study of targeted areas is being performed, and a large-scale geological survey is being conducted. The following remote-sensing imagery materials are used, depending on the scale of the maps being prepared: continent-level images taken by Meteor satellites; regional-level imagery taken by Kosmos satellites, manned Soyuz spacecraft, and Salyut orbital stations; high-altitude and conventional aerial photographs, radar and infrared airborne imagery. Multiple-frequency-band imagery from aircraft and orbital platforms is extensively employed. There is operating in the USSR a system of obtaining, processing, and disseminating remote sensing materials, encompassing a large group of geological subdivisions. It includes the lead organization of the USSR Ministry of Geology -- the Aerogeologiya Association, more than 10 laboratories at scientific research institutes, and more than 50 specialized aerospace geological teams supported by geology administrations and territorial production geological associations. This system ensures orderly and systematic utilization of remote-sensing imagery materials in geological mapping. A definite contribution toward development of remote-sensing techniques is being made by Soviet cosmonauts, who during manned missions make visual observations of geologic features and conduct purposeful photography of the Earth's surface with hand-held and spacecraft-mounted cameras, as well as spectrometry. They undergo the requisite training to perform this work, and they are assigned specific tasks by geological organizations, consisting for the most part in checking out promising structures in certain areas. Cosmonauts have the opportunity to observe the same locality at different times of day, under different lighting conditions and, in addition, at different times of the year. And they are able to spot structural elements which are poorly visible in photographs or which are subject to some question. If a structure is confirmed, cosmonauts document it with the aid of cameras or make sketches of it. One cannot say that they do not display initiative or that they limit themselves strictly to their assignment. There have been instances where cosmonauts have discovered new, previously unknown structures. Such assignments are given for the most part to crew members of extended missions, but visiting crews have also been given such assignments. Sigmund Jaehn, for example, carefully observed the territory of the German Democratic Republic. I might also mention the work done by Anatoliy Berezovoy and Valentin Lebedev. They noted down on onboard space navigation charts more than 300 features of a geologic nature, including linear and ring-shaped structures on our country's territory which were not clearly evident on space photographs or which had previously not drawn the attention of specialists engaged in geologic photointerpretation. A number of specialized maps have been prepared from space imagery materials, including a Space Geologic Map of Linear and Ring-Shaped Structures on the Territory of the USSR, on a scale of 1:5,000,000, a Space Phototectonic Map of the Aral-Caspian Region, on a scale of 1:2,500,000, a Space Geologic Map of the USSR, on a scale of 1:2,500,000, and space geologic maps of various large regions of this country.

[Question] Many delegates who spoke at the congress mentioned that each session is a meeting of the past with the present. In this connection, what development trends did you see in remote-sensing methods of investigation in geology?

[Answer] First of all, the development of methods aimed at determination of the substance composition of rocks (multiple-frequency-band, aerial geochemical, laser), and improvement of the technology of regional geologic studies and mineral prospecting. A great deal here depends on development and technical support of technology of automated processing of imagery and digital processing of lineament maps. Zonation of the territory of the USSR on the basis of geologic-topographic conditions will continue.

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## COACH OF ARMED FORCES HELICOPTER COMPETITION CHAMPIONS

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 11, Nov 84 (signed to press 3 Oct 84) pp 26-27

[Article, published under the heading "Aviation Sports," by Col A. Gokun': "Mentor of Champions"]

[Text] In recent years victories by expert sport helicopter pilots trained by Lt Col G. Ivanov, coach at the Syzran Higher Military Aviation School for Pilots imeni 60th Anniversary of the USSR, have become traditional at USSR Armed Forces and Volga Military District helicopter sport championships. This year as well the school's team won the team title at the USSR Armed Forces 22nd helicopter sport individual and team championships. A. Korniyets, captain of the Volga Military District team, took the individual title, and V. Degtyar' was runner-up. V. Degtyar' won the individual title at the 25th USSR Helicopter Sport Championships, held this year in Yegoryevsk.

Coach G. Ivanov has trained Master of Sport International Class V. Osborne, twice champion of the USSR, V. Bolvachev, V. Iskurov, V. Viktorov, and R. Safin, repeated winners of various championships, as well as other virtuoso helicopter pilots.

What is it -- coach's luck, a fortunate selection of talented sport helicopter pilots, or the result of purposeful, hard work by an experienced mentor? We shall not give a hasty reply. In sport helicopter flying, probably as in no other sport, success does not come by chance. It is preceded by long, painstaking work on the part of the pilots, and it involves the coach's professional and life experience.

Gennadiy Ivanov first entered aviation 30 years ago. He flew piston aircraft, mastered the MiG-15 jet, received an officer's commission and became an instructor pilot. He was one of the first to train over to helicopters, and he gained great affection for them due to the beauty of low-altitude flying, their reliability, tractability, and excellent maneuver capabilities.

Experience came with knowledge -- Ivanov graduated with distinction from a higher aviation school as a correspondence student. Becoming involved in helicopter sport, he qualified for USSR Master of Sport. An excellent methods specialist, he was nominated for a position in the flying methods department

at the Syzran Higher Military Aviation School for Pilots. It was at this time that Lieutenant Colonel Ivanov became coach of the school's helicopter team.

He grasped the main thing from the experience of his predecessors: the entire year cycle of helicopter pilot training activities and their participation in various competitions should be viewed as steps toward a major goal -- to train genuine aces, who are capable of achieving the highest results in USSR Armed Forces and Soviet Union championships. The coach reveals, cautiously and without haste, the individual flying abilities of team candidates, their psychological stability, their knowledge of theory, and their ability to defend the school's athletic honor and reputation.

Experienced master-rated helicopter pilots A. Korniyets, P. Vasil'yev, A. Bezrukov, V. Degtyar', and G. Kuz'michev (alternate) were named to the school's team in 1984. This is a well-established group of sport pilots, with whom Ivanov has been working for years.

It is interesting to observe practice sessions. They are conducted at a rapid pace, in a competitive environment. The helicopter pilots' errors and good performances are critiqued and analyzed immediately, right on the spot. As a rule each such practice session -- a new step toward improving the flying skills of the helicopter pilots -- is preceded by thorough training in theory, precise calculation, and bold experiment.

Gennadiy Antonovich once read an article on meteorology, which contained new data on the mechanisms of influence of a water surface and topography on air density and temperature at low altitudes during the period of daylight on a summer day. We should note that Ivanov has always jotted down his observations. Over a period of several years he had amassed a fairly large file of notes. The pilots studied the route coverage schedules as well as differences between ETA and actual time over waypoints and at destination. They compared observed data and the results of analysis of factual material. The mechanisms indicated in the article were confirmed. The reasons for navigator errors in route calculations were determined. They took all this into account in preparing new cross-country route timetables. They then checked these figures in the air during practice sessions. The sport pilots' accuracy of orientation and helicopter navigation improved significantly.

Here is another example. While working on the expert program maneuver "Ground-skimming helicopter slalom, carrying a bucket of water between the gates, subsequently placing it on a table, for time," Lt Col G. Ivanov noted some roughness in the performance of the A. Bezrukov-V. Degtyar' crew. He sent them up to run through it several times, but the helicopter pilots failed to turn in a clean performance.

Of course it is no simple matter to carry a 5-kilogram bucket of water, suspended on a long tether, between numerous slalom gates to the accompaniment of roaring engines and the slapping sound of the main rotor. And the pilot must avoid hanging the bucket up, splashing water out of it, and at the finish line he must precisely place it onto a mark on the judges' table. Particular smoothness in the functioning of the crew and the ability to have a feel of



the aircraft are necessary. Of course this is not an easy task. But Lieutenant Colonel Ivanov found an unexpected solution.

"We shall run through the event in a more difficult variation -- without switching on the intercom," he instructed. "You must learn to understand each other without a word being spoken."

He also focused attention on improving the general physical conditioning of the helicopter crewmen. And results were soon in evidence -- the crew began performing with great precision in the air.

Gennadiy Antonovich devotes particular attention to working on the routine "Flying at ground-skimming height while executing a group of maneuvers along a marked course, for time." This is a "classic" routine for expert pilots, a graduate course in helicopter flying. The square course area is small: 50 by 50 meters. But within this square the pilot, flying in close proximity to the ground, must fly the helicopter with precision sideways and tail first, and execute fast turns.... Only if the pilot functions with his helicopter as a smoothly integrated system is he capable of performing such a task, and for time at that -- additional points are given for execution time. Here, within the square, the coach sees all the sport helicopter pilots' errors and mistakes. And his task consists in finding ways to correct them.

Here is an example. A. Korniyets, member of the USSR national team and the school team, displayed excellent technique flying in the square. His performance seemed flawless, and he earned a considerable number of bonus points.... But the performance was achieved at the cost of great effort. He lacked ease and elegance of execution. What could be done? How could this pilot be helped? Lieutenant Colonel Ivanov found a solution. He removed the sport pilot from the practice session and had him act as coach in rehearsing this routine. Ivanov's plan was simple. The sport pilot had to see himself from a distance and comprehend his principal mistake. And his mistake lay in the fact that in the pursuit of scoring points he had lost his sense of flying smoothness -- a finer point of a performance routine without which particular precision and beauty are impossible. During subsequent practice sessions the coach and pilot reworked the timetable for the routine in the square, worked on the routine element by element, and achieved the requisite cleanness of flying technique.

Lieutenant Colonel Ivanov has also done a great deal of work in the square with the other sport pilots. Ultimately all three top places in the USSR Armed Forces championships in this routine were won by members of the Volga Military District team.

So what is after all the secret of the success of the Volga Military District people? Why do they always win helicopter competitions? The answer is simple. Through hard work they achieve a high level of flying proficiency, confidence in performing every routine, and the ability to perform calmly and

precisely. And they carry this level of proficiency over to the championship competitions. This too is a result of the work of the champions' teacher, Military Pilot 1st Class Lt Col Gennadiy Antonovich Ivanov, and it is his finest reward.

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## GLIDERS RECOMMENDED FOR STUDENT PILOT TRAINING

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 11, Nov 84 (signed to press 3 Oct 84) p 28

[Article, published under the heading "The Reader Reflects," by Pilot Cadet A. Tsaruyev: "I am a Booster of Soaring"]

[Text] Quite some time ago I read an article by writer V. Kazakov entitled "Undeservedly Forgotten" [AVIATSIYA I KOSMONAVTIKA, No 6, 1983]. The author suggests a return to gliders as a means of pilot basic flight training. I am also concerned by this problem. And here is why.

Prior to enrolling at the Order of Lenin Yeysk Higher Military Aviation School for Pilots imeni Twice Hero of the Soviet Union Pilot-Cosmonaut USSR V. M. Komarov, I flew sailplanes for 2 years with the Ordzhonikidze Aviation Sports Club. I have logged 30 hours on the L-13 Blanik sailplane. At the time I had no idea that soaring would give me piloting skills which would come in quite handy when transitioning to the L-29 jet.

I cannot say that my first L-29 flights went smoothly. At first I had trouble mastering straight and level flight, maintaining desired instrument readings, taking off, and holding heading on the takeoff roll. I did not feel any difference, however, between landing an airplane and landing a glider. They are very similar. The approach to the ground is the same, in spite of the difference in landing speeds. Height of initiation of roundout is also different (2 meters for the sailplane, 6-8 meters for the airplane), but the ability to determine height at which to initiate roundout, which I had developed on the glider, never let me down.

It seems to me that the process of roundout, holding flare, and touchdown is simpler with the L-29 than with the glider. During landing the glider is very sensitive to elevator control: the slightest excessive rearward pressure on the controls leads to ballooning, while high flare and ballooning are the principal scourge of first-year and even second-year pilot cadets. And all because the student pilots do not sense the rate of approach of the ground and, as a consequence, incorrectly pull back on the controls.

Flying a sailplane hones student pilots' sense of rate of ground approach on landing, a sense which is lacking in novice pilots. Many students experience

difficulties during approach, in gauging and executing the landing. There is a good deal of work on the final approach glide: the pilot must monitor airspeed, reduce rpm, establish his glide to the roundout point, communicate with the tower, etc. The student has neither adequate time nor attention for all this. Few student pilots feel confident on final approach during their first flights. A student may fail to maintain proper heading, may allow airspeed to drop off, or fail to maintain a constant glide angle. On a glider, however, all these elements are mastered comparatively more rapidly and more easily. Everybody who has flown a sailplane will tell you that.

A sailplane provides the opportunity to master rapidly, inexpensively, and without any negative effects (during transition to a jet) the most varied elements of flight and even air combat maneuvers, elementary formation flight and, of course, the most important thing -- landing.

What about negative effects? I did not note any such effects upon transitioning from the Blanik sailplane to the L-29 aircraft, and I believe that a second-category glider pilot who has logged 35-40 hours on Blanik or Kobra sailplanes will be able to solo on the L-29 after practicing maintaining flight conditions and attitudes in the cockpit simulator and several dual flights to work on mastering holding the nose gear up, maintaining heading on the takeoff roll, raising and lowering landing gear and flaps, and plotting the landing approach configuration in local conditions.

And how about a glider with a tall tricycle landing gear, high landing approach speed, a glider on which flight instruments and control pressures are distributed as on an airplane? This would promise savings of thousands of tons of fuel and more hours logged over a year's time. And what about a power-off landing onto an airfield or emergency landing site (a glider pilot can extend his spoilers and obtain a rate of descent of 10-30 m/s, like on an airplane)?

A glider has many strong points. It enables the pilot to gain a truly acute feeling of flight and to feel incomparable joy. Another important point is the fact that far fewer student pilots will wash out. The sport of soaring contains not only romance and the joy of flight. It is also a fine basic training school for flight personnel.

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#### GREATER AVIATOR ATTENTION TO AVIATION MEDICINE URGED

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 11, Nov 84 (signed to press 3 Oct 84) p 29

[Article, published under the heading "Aviation Medicine for the Pilot," by Doctor of Medical Sciences and Professor Col Med Serv (Res) P. Isakov [deceased] and Candidate of Medical Sciences Col Med Serv I. Alpatov: "Call of the Times"]

[Text] Officer A. Bekhterev had a great deal of flying experience; he had always done considerable flying and liked flying, carrying out assignments with excellent performance. But that day he had to settle a number of pressing job-related matters prior to departure, and the pilot was hurrying. He felt pressed. When he took his seat in the cockpit, he forgot to connect his oxygen hose. Engine start, taxi, takeoff -- he had to go through the procedures hastily.

In the air Bekhterev felt sluggish and tired. Soon the face-piece of his pressurized helmet began to fog up, but the pilot paid no attention to this. But when the ATC controller radioed persistent commands to get back on course and maintain altitude, he came to his senses, discovered the malfunction in his high-altitude gear, and corrected the problem. This veteran aviator had forgotten that the laws governing the physiology of flying, just as other laws pertaining to flying service, are strict and must be obeyed unswervingly.

The role of medical factors in ensuring effectiveness and safety of flight operations is steadily growing. The history of aviation attests to the fact that new medical problems arise as equipment becomes more complex. In the prewar years many aviation accomplishments and records were determined to a considerable degree by solving a number of health-and-physiology problems pertaining to protecting aircrews against the effects of low temperatures, hypoxia, vibration, and other adverse factors of flight. An increase in aircraft speeds and maneuver capabilities required the development of methods of protection against the effect of accelerations, as well as improvements in oxygen-breathing and other high-altitude gear.

At the present time the specific significance of psychophysiological and ergonomic tasks is quite high; the role of some traditional methods of medical support of flight operations is also growing. For example, observance of

pre-flight work and rest routine, and proper utilization and maintenance of flying gear. Specialization of flying labor and the increasing complexity of tasks performed by aviation define the need for devising and selecting new, more effective forms both of initial briefing of flight personnel on medical aspects of flight operations support and subsequent personnel training and preparation in this regard. The pilot should have a clear understanding of the mechanism of operation of adverse factors, should be aware of potential consequences, and should not ignore the requirements of medicine.

Study of aviation medicine is part of the flight personnel training curriculum. Flight surgeons do a great deal of work in the units. At the same time the pilots themselves are also interested in medical matters. Practical experience indicates, however, that this interest does not solve all problems. It is essential to form in aviation personnel firm professional conviction reinforced by corresponding training and thorough knowledge. Unfortunately there still occur many instances where crew members incorrectly use and maintain flight gear, fail promptly to inform doctors when they are not feeling well, and fail to observe the pre-flight regimen.

A high degree of pilot working efficiency when flying during the effect of adverse factors is ensured not only by properly-fitting high-altitude gear and proper operation of life-support systems, but also knowledge of symptoms indicating change in state of health due to various causes. For example, agitation connected with the complexity of a task can cause an increased breathing rate and hyperventilation, as a rule accompanied by dizziness and a feeling of numbness of the extremities. If the pilot is unaware of this, he may interpret such symptoms as signs of hypoxia, which will result in a wrong decision.

Flight personnel must be taught unswervingly to observe the requirements of aviation medicine and must be taught the ability to recognize the causes of feeling ill. This training should be organized on a scientific basis and incorporate graphic presentation. Training films and flight personnel manuals on aviation medicine are very useful. For example, a book by K. Platonov entitled "Chelovek v Polete" [Man in Flight], which has gone through several editions, continues to be of universal reader interest. Aviation personnel will obtain much of value from such books as "Problemy Teorii i Praktiki Aviatsionnoy Meditsyny" [Problems of Theory and Practice of Aviation Medicine] (a collective-authorship volume), "Letchiku o Psikhologii" [Psychology for the Pilot] (by B. Pokrovskiy), "Chelovek v Ekstremal'nykh Usloviyakh" [Man in Extreme Conditions] (by V. Volovich), and others. It is significant that these books have sold out literally within a few days.

Unfortunately not all books on aviation medicine are as well done. For example, a book entitled "Aviatsionnaya Meditsina" [Aviation Medicine], A. Babiychuk, editor, was published in 1980. It certainly contains useful information (in particular, the little-discussed but important question of flights involving the crossing of several time zones), but it also contains a number of obvious deficiencies. One is also surprised at the list of recommended literature. It contains for the most part items written by the book's editor, and most of them are papers presented at meetings of scientific

societies and conferences, which essentially are not published works available to the general public.

Leading experts in the field should be enlisted to devise optimal forms of teaching and dissemination of aviation medicine. The need for specialized publications for flight personnel on relevant issues of aviation medicine is a demand of the times.

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#### SQUADRON MAINTENANCE SUPERVISOR QUALITIES OUTLINED

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 11, Nov 84 (signed to press 3 Oct 84) pp 30-31

[Article, published under the heading "Know-How of the Best Into the Combat Arsenal," by Maj Gen Avn A. Grishin, Air Forces deputy commander in chief for aviation engineering service, chief engineer, air forces, Red-Banner Odessa Military District: "Squadron Engineer. What Should He Be?"]

[Text] Demands on those who directly service and maintain modern aircraft systems, on their level of professional knowledge, skills, quality of technical training and work performance have increased immeasurably today. Success in the flight operations performance of military units as a whole is determined in large measure by how precise is the pace and rhythm of combat training of engineers, technicians and junior aviation specialists and how knowledgeably and with what degree of teamwork and cooperation they service and maintain the equipment and weapons entrusted to their care, displaying thereby a high degree of discipline and organization.

One can scarcely exaggerate in this regard the role and significance of the squadron deputy commander for aviation engineer service [AES] as that officer who is directly responsible for maintenance and repair of aircraft equipment and keeping aircraft in a continuous state of combat readiness. In the air forces of the Red-Banner Odessa Military District there are many officers of this category who perform their duties in an exemplary fashion.

The following fact is cause for concern, however: one observes in the activities of unit engineers in charge of the specialized areas a tendency toward excessively close supervision over the maintenance specialists in their services, which leads to a weakening of the influence of the immediate organizers of aviation engineer service -- the squadron deputy commanders. This is a hindrance.

What do we envisage as today's military engineer serving as a squadron deputy commander for AES? What qualities should he possess in order to enjoy a high degree of respect in his subunit and to be a genuine organizer of the technical training of the maintenance specialists? These questions occupy the attention focus of commanders and political workers, staff officers and party



activists, all those involved in operation, servicing and maintenance of modern aircraft systems.

The squadron deputy commander for AES bears great responsibility not only for ensuring the reliable operation of aircraft and maintaining them in a continuous state of combat readiness, but also for training and indoctrination of engineer and technician personnel. In order to perform his job-related duties, he must first and foremost possess consummate knowledge of the combat aircraft in service, the rules and procedures pertaining to their maintenance and repair, he must have the ability correctly to plan and schedule aircraft overhaul activities, routine inspection and maintenance, and he must continuously analyze the state of the equipment. In addition, the squadron deputy commander for AES, together with the squadron commander, devises and implements measures to ensure a high degree of aircraft reliability and flight operations safety, and determines the manner and procedure of deployment and safeguarding of ground servicing equipment and facilities.

Of course the subunit aviation engineer handled such items in the past as well. Nevertheless today, when one must practically continuously study, service and maintain new, increasingly more complex aircraft, the demands on the professional level of every leader have increased many times over, and this includes the engineer, his organizing abilities, and his ability to work innovatively and with an eye to the future. Today relying on working instinctively or intuitively is out of the question, even in small things. Every decision should be scientifically substantiated, and every action should be carried out with a high degree of professionalism, without the slightest departures from established rules and procedures.

In present-day conditions, in addition to the personal qualifications of the squadron deputy commander for AES as a specialist and equipment expert, his organizing abilities, initiative and businesslike efficiency advance to the forefront, as well as his ability to organize the components of the aviation engineer service in such a manner that they are all equally strong, reliably supporting high-quality, orderly work performance by aviation personnel.

Advanced know-how does not lie on the surface; one must look for it, and only then adopt it. Unquestionably this is no simple matter. But here is what is remarkable: the ability to sense the new, to work painstakingly, day after day, selecting, classifying all the finest things achieved in the process of servicing and maintenance of modern aircraft equipment, and aggressively adopting it into AES practical work activities has always distinguished our finest aviation engineers at the squadron level. In learning all new innovations from others, they themselves become carriers of advanced know-how.

Squadron deputy commander for AES Maj P. Borodatov, for example, has time enough for everything: for independent study, for organization of maintenance work on aircraft, and for checking aircraft preflighting. It would seem that there is nothing special in his experience and know-how, since this officer is merely performing his job duties. But how is he performing them? A great deal is revealed here. He endeavors to organize in a scientific manner the work activities of the aviation engineer service specialists. This is particularly important in conditions of intensive activity during the period

of mastering new aircraft, and the urgent necessity of flawlessly resolving a large number of various matters, many of which are arising for the first time. It is very important here to have the ability to make every minute count, to know on what one has specifically expended one's time, in order to utilize it with maximum return and to achieve excellent results in all assigned work areas. Maj P. Borodatov organizes work in the squadron precisely in this manner.

The subunit aviation engineer service headed by S. Kozachuk is also successfully accomplishing its tasks. As squadron deputy commander for AES, he arranges his relations with his subordinates and organizes work in the outfit on the basis of amassed know-how. And there is plenty of this. Officer Kozachuk served as an aircraft maintenance technician, flight technical maintenance unit chief, and subsequently headed a servicing and maintenance group. An expert at his job, he is thoroughly familiar with the job duties of his subordinates and knowledgeably directs their activities, thoroughly and comprehensively studies the specific features of design, construction, servicing and maintenance of the aircraft equipment, and has the ability correctly to organize preparation of aircraft for flight operations.

Captain Kozachuk considers as a guarantee of his successful performance, and not without justification, advance personal preparation for assigning the squadron's engineers and technicians tasks for the next work day and verification of organization of labor in one of the flight technical maintenance units or in one servicing group, with simultaneous practical demonstration directly on an aircraft, which has become a firmly-established practice. He also devotes considerable attention to instrument testing, constantly concerning himself with the operational readiness of operators and specialized vehicles.

There is no doubt about the fact that the experience of these and other leading squadron AES officer-leaders which all have adopted, will greatly assist unit commanders and their deputy commanders for AES in teaching subordinates the skill of servicing and maintaining aircraft in a methodologically knowledgeable manner and on a high professional level, and will help them actively influence personnel with the aim of improving qualitative indices in combat training.

We have not yet succeeded, however, in achieving a high level of methods training of all subunit deputy commanders for AES without exception. It sometimes happens that during flight operations or on the day of immediate preparations for flight operations they fail to perform their vanguard role, as is demanded by guideline documents and Armed Forces regulations. Just prior to beginning a working day, for example, Maj I. Grigorashchenko assembled his men and gave them extremely brief instructions -- essentially he only announced the tail numbers of the aircraft on which they would be performing required procedures and reminded them about safety procedures when working on aircraft. This was essentially the limit of his role as organizer of work on the aircraft. Officer Grigorashchenko did not even take the trouble to remind the maintenance specialists of their socialist competition pledges, let alone organizing among technician personnel and junior aviation maintenance specialists competition for higher performance results. A

question logically arises: what kind of positive performance results can be expected of the men on this workday?

Or take another case. Experienced deputy commander for AES Maj. V. Pasechnik seems to have thought through well the work organization of the servicing groups and flight technical maintenance units and their coordination, and he specified the time and sequence of utilization of ground equipment and facilities. Pasechnik was unable, however, to communicate his work schedule to his men in a comprehensible manner, so that each technician and mechanic precisely understood the sequence of his work procedures. As was to be expected, the result of the men's labor during the work day proved to be poor.

Among the AES supervisors in the squadrons there are officers who only recently completed their specialized higher education. They had been performing different work tasks prior to completing the higher educational institution and being promoted to a higher position, and they had far fewer men under them. Having become AES supervisors, they encountered a number of difficulties. They frequently lack experience in organizing, planning and scheduling their work. For example, Capt N. Aref'yev, graduate of a higher aviation engineering school, who was recently assigned to the position of squadron deputy commander for AES, at first was unable correctly to distribute his manpower and inefficiently utilized work time. He was unable to set up mutual relations as prescribed by regulations with the flight technical maintenance unit and servicing group chiefs. His low level of demandingness soon had an adverse effect on the quality of preparation of aircraft for flight operations.

In view of facts of this nature, we devote certain attention to the period of familiarization of this category of officer, teaching them correctly to organize their labor and establish mutual relations with their subordinates. Toward this end the units utilize not only classes within the commander training system but also technical conferences, critique and analysis sessions, brief drills, and presentations by experienced engineers.

A special role in training and indoctrination of subunit aviation engineer service supervisor personnel is unquestionably played by unit deputy commanders for AES. The respect a supervisor enjoys is determined first and foremost by his moral fiber, excellent professional and methodological preparation, and level of competence. The majority of our unit deputy commanders for AES possess the requisite qualities. As a rule these are innovatively thinking people, who have a good understanding of the sociopolitical aspects of scientific and technological advance, men of initiative, who are demanding and at the same time sensitive toward their subordinates.

Nevertheless their methods work with the squadron deputy commanders for AES cannot be considered as satisfying all the demands of modern education science and psychology. This is due to the fact that not all of them have gone through the difficult but necessary school of deputy squadron commander. And if they have, their schooling has been insufficient. We organize our work with them in conformity with this.

Naturally the closest attention is required by those officers who have been assigned for the first time to the position of squadron deputy commander for AES. At training conferences and scientific-technical conferences as well as in the process of independent study they assimilate their job duties, study positive work experience in the units, and gain an understanding of the basic points of the documents which govern aviation engineer service. This enables them to develop a picture of the job of squadron deputy commander for AES and more knowledgeably to construct their mutual relations in the outfit.

We conduct training methods work with deputy commanders for AES in a systematic manner, holding demonstration and instruction-methods classes and conferences incorporating the experience and know-how of the best engineers, and we boldly adopt their methods innovations. In this way we achieve further enhancement of the role of squadron deputy commander for AES and his influence on personnel in the campaign for a high degree of effectiveness and excellent quality of aircraft servicing.

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## TSIOLKOVSKIY NUMBER AND FORMULA EXPLAINED

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 11, Nov 84 (signed to press 3 Oct 84) p 31

[Article, published under the heading "Briefs": "Tsiolkovskiy Number and Formula"]

[Text] A rocket booster differs from other known flying vehicles primarily in the sequential operation of the separate stages and in the fact that the reaction mass and energy are concentrated on board the vehicle and are not borrowed from the ambient medium. These seemingly negative properties of a rocket make it possible to obtain the main result -- to achieve the velocity required to lift a payload into Earth orbit (appr. 8,000 m/s).

All the fundamental principles of booster design were formulated and substantiated by the founder of astronautics, K. E. Tsiolkovskiy. He derived the formula which bears his name. According to this formula, the final velocity attained by a rocket in the absence of gravity and aerodynamic drag is determined by the velocity of outflow of mass and the ratio of propellant mass to rocket dry mass, which is called the Tsiolkovskiy number ( $K_{ts}$ ). At the early stages of booster design, engineers sought to increase  $K_{ts}$ , as they considered this criterion to be one of the most important. The U.S. Atlas booster, for example, had a  $K_{ts}=13$ , which is close to the theoretical limit.

The next distinctive principle of boosters is that they are constructed in stages, that is, sequential operation by separate units. K. E. Tsiolkovskiy formulated this principle in 1926 in his "Issledovaniye Mirovykh Prostranstv Reaktivnymi Priborami" [Space Exploration by Rocket-Propulsion Devices] (new edition). The Tsiolkovskiy formula, for the case of a multistage rocket, makes it possible to determine attainment of orbital velocity with practicable  $K_{ts}$  and mass outflow velocities. Theoretical calculations of booster trajectories and allowable structural loadings made it possible to establish near-optimal losses to gravity and aerodynamic drag: approximately 1,300 and 200 meters per second respectively. Therefore in preliminary estimates final velocity in the Tsiolkovskiy formula is taken not as 8,000 m/s, but 9,500 m/s.

If with given  $K_{ts}$  and exhaust velocity quantities this value was satisfied with a number of stages equal to P, one can proceed with detailed designed of a P-stage booster.

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## CAREER OF AFGHANISTAN HERO SOVIET HELICOPTER PILOT OUTLINED

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 11, Nov 84 (signed to press 3 Oct 84) pp 32-34

[Article, published under the heading "Years, People, Deeds," by Col Ye. Besschetnov: "The Attraction of Altitude"]

[Text] Party member Military Pilot 1st Class Maj V. Gaynutdinov was one of the first to be awarded the coveted title Hero of the Soviet Union for successful accomplishment of the mission of rendering internationalist assistance to the Democratic Republic of Afghanistan and for courage and heroism displayed in performance of this mission. This officer flew dozens of very difficult missions. One of them proved fatal.

The inexorable advance of time with each passing day separates us ever further from the events in which Vyacheslav Karibulovich took part. The aviators who have replaced their predecessors want to know what kind of a person he was, what kind of job he did, and what kind of mark he left in life. I was able to meet people who knew him well. Here is what they told me.

(Lt Col V. Shcherbakov, Hero of the Soviet Union, former helicopter squadron commander): Major Gaynutdinov and I served together several years. We flew together in the skies over Afghanistan, and we got into various scrapes together, but he never lost his optimism. And another thing I found appealing about him was his responsiveness, his genuine concern for his fellow man, and his inexhaustible love for people. I recall a typical incident.

The day had been a busy and difficult one. Everybody was rather tired when they finally sat down to supper. Suddenly guttural voices were heard on the other side of the wall. Gaynutdinov stood up and walked out. The other officers followed him. There were five agitated Afghans at the gate, asking the guard to let them see the officer in charge. Learning that Gaynutdinov was our senior officer, they proceeded, all talking at the same time, to explain to him what had happened.

It seems that a kishlak [village] had been visited by a band of Basmachi [counterrevolutionary bandits], who wanted to stock up on provisions. The

rebels had made raids in the past, stripping the population of everything they could take. Curious youngsters came out onto the square to see what was going on. A little boy about 5 or 6 years of age had a piece of unleavened bread in his hand. "What do you mean you have no food?" the leader of the gang thundered. "And just what is this?" One of the dushman [bandits] moved toward the little boy, apparently intending to take his bread away from him, but the boy drew his hand back. The bandit then drew a knife and slashed the child's stomach. Blood gushed out in a scarlet stream. The anger of the villagers, enraged by this vicious act, was so great that the bandits beat a hasty retreat. But the child was in a bad way....

Gaynutdinov, after listening to the village emissaries' tale, headed for a helicopter standing nearby, carrying tail number 53, and gestured for the Afghans to follow him. "You will show me where your village is, how to get there," he said. In spite of the fact that Vyacheslav Karibulovich had logged more air time that day than any of the others, hauling supplies, he nevertheless decided to go up himself. When I suggested he send somebody else, he explained: "There is a risk involved here. The dushman may have only pretended to leave the area. They could hit the helicopter from ambush. In addition it is getting dark; it will not be easy to land the bird." Incidentally, this was part of his character. He often would undertake the most difficult, the most risky assignments.

What happened then? They flew to the village and landed on the village square. The villagers were waiting impatiently for them. They placed the child, weak from loss of blood, on board the helicopter. One of his relatives, who had decided to accompany him, also climbed aboard. The helicopter crew delivered the victim to our field hospital. Soviet doctors proceeded to fight for the lad's life.

It was already dark when the crew returned to the airfield. And the next morning there were new sorties and new concerns. But Gaynutdinov, as all of us, did not forget the little boy. We would contact the hospital and ask how he was doing. How pleased everyone was to learn that he was on the mend! And when the child returned to his native village, we were informed that his parents, as a sign of gratitude to the Soviet pilot and in his honor, had given their son an additional name -- Slava.

Our helicopter crews did quite a few good deeds of various kinds. The Afghans saw with their own eyes who was their friend and who was their enemy. I remember that after this incident the local people gained particular respect for us. A self-defense detachment was formed in the kishlak. The dushman never showed their faces there again, fearing the people's wrath....

(Karibula Gaynutdinov, father, retired captain): I don't believe that our older son ever asked himself the question: what shall I be when I grow up? As long as he could remember, he had been exposed to the military. I myself was a combat officer, marched along the flaming roads of the war from the first day to the last, and served many years after the war in remote garrisons. Slava always dreamed of going into the military. He was born on the day when we were celebrating the 30th anniversary of the Great October Revolution. The fact is that this was a mere coincidence, but my son took it to be a special



omen. He said that a birthday connected with the greatest national holiday carries a lot of obligation with it. After finishing school in 1966, he enrolled at the Syzran Military Aviation School for Pilots. I remember asking him why he had not gone to tanker school. He replied: "I am attracted by helicopter flying; the future belongs to it!" Indeed, in those years it was becoming increasingly popular.

Vyacheslav was a sensitive, caring son. He wrote mother and me often, telling us about his studies and work and sharing his thoughts about the future. He always sent us holiday greetings. And whenever he would come home on vacation he would try to do something around the house, to help us. He was always happy and cheerful. He liked to sing, to play the accordion, and the clarinet -- after all, he was a music school graduate.

The four years of training passed quickly. Vyacheslav came home wearing a brand-new officer's uniform with lieutenant's shoulderboards. When his leave was over he left to report for duty with the Northern Group of Forces.

He gradually acquired a nice, harmonious family. In spite of the fact that he was extremely busy with his military duties, he devoted a great deal of attention to his wife Lyudmila, his little boy Sasha and his little daughter Natashen'ka. The state has taken care of his family -- it has given them an apartment in Moscow, as well as financial assistance.

(Col V. Rushinskiy, bearer of the Order of the Red Banner, Air Force tactics instructor at the Air Force Academy imeni Yu. A. Gagarin, former regimental commander): I first met Vyacheslav Karibulovich in the helicopter regiment to which he was assigned upon graduating from the academy. He was a lieutenant at the time. Although he had not been an officer long (only two years), he was universally respected in the outfit. He was commander of an Mi-8 helicopter, flew day and night, in VFR and IFR weather, and did a fine job flying combat sorties.

I remember that a couple of months after my arrival a vacant flight commander slot opened up. Whom should I give it to? There were three qualified candidates. The regimental authorities and methods council selected Gaynutdinov. Contributing factors included his excellent flying proficiency, his ability to make friends quickly and, of course, his discipline, efficiency, great composure, and an activist record in volunteer activities. Incidentally, amateur talent activities were well organized in the regiment. And Gaynutdinov played various musical instruments very well. He was a gifted fellow. We subsequently became convinced that we had been correct in promoting him to a higher position. He soon demonstrated that he was a good methods specialist and a skilled teacher to his men. The flight he commanded constantly held one of the top positions in the regiment in socialist competition results. In three years he was promoted to squadron deputy commander.

(Col Gen Avn I. Belonozhko, at that time commander of the air forces of the Red-Banner Central Asian Military District): Gaynutdinov came to our district as a replacement. He served for some time as a squadron deputy commander, but he was soon promoted. This officer was distinguished by excellent knowledge

of his job, fine flying ability, a high degree of businesslike aggressiveness, and the ability to solve problems with initiative. He was an excellent pilot and a man of infinite bravery. And how he could fly! He had an exceptionally fine feeling for the helicopter. He possessed truly virtuoso flying technique and had the ability to teach this to others....

(Col V. Rushinskiy): Our paths happen to cross again: a year later I was reassigned as a replacement to the same district. Soon I was made regimental commander. Vyacheslav Karibulovich was promoted and assigned to our regiment. In less than 10 years he had grown, practically before my very eyes, from a rank-and-file pilot to a very capable aviation leader of men, and this was quite logical. Gaynutdinov had a strong sense of duty, felt a great deal of responsibility for the assigned task, and was a truly gifted pilot. He was faced with many difficult tasks in his new job. For example, he had to master flight operations officer duties (at that time he was not yet certified). Vyacheslav Karibulovich went to work with a will! And he not only deeply and thoroughly studied the guideline documents but also soaked in like a sponge the experience and know-how amassed by the more highly-trained officers, working to master his job-related duties with the eagerness and enthusiasm of youth. Within 3 months he passed the examinations and commenced directing flight operations in all weather, day and night.

That training year which had commenced was a difficult one for us. We had pledged to develop a large number of pilots and improved proficiency-rating specialists. Gaynutdinov went aggressively to work. He did a great deal of painstaking work with the commanders, correctly maintaining that the better the leader-officers are prepared, the more smoothly and productively the training process will move ahead, and the better the results will be. He did not permit the slightest unnecessary situation simplifications in training, and he was rigorously demanding. Incidentally, at this time he himself was enrolled as a correspondence student in the Air Force Academy command faculty. Gaynutdinov unquestionably deserved part of the credit for the fact that by year's end every two out of three of our pilots earned first and second class, while the remainder were for the most part recent service-school graduates.

(Lt Col V. Kopchikov, bearer of the Order of Lenin and Order of the Red Banner, former squadron deputy commander for political affairs): as things worked out, Major Gaynutdinov, coming to the aid of the toilers of Afghanistan, flew most of his missions with our squadron. Vyacheslav Karibulovich considered it his primary obligation to carry out his internationalist duty in an exemplary fashion. His routes of flight ran over boundless, totally featureless desert and over mountains or through mazes of mountain gorges. I can state from my own experience that it was not easy. But Gaynutdinov's crew worked steadfastly to overcome difficulties, always promptly delivered to the local population grain, foodstuffs, shoes, clothing, and various other supplies, and carried out sick and injured. Of course most frequently they would have to fly to the most remote locations, accessible only by air.

In the winter of 1980 Gaynutdinov, together with the men of our squadron, spent more than 2 months flying various passengers and cargo to the city of

Faizabad, which at the time had been cut off by the rebels from the rest of the country. High mountains, frequent fog and low overcast, and a lack of ground nav aids made things extremely difficult for our aviators. In addition, the dushman would lay in wait for helicopters and fire on them at the first opportunity.

Every flight involved risk. The crew refused to buckle, however, and took everything that was dished out. And the main credit for this of course goes to Gaynutdinov. He displayed an example of staunchness, courage, and valor. He flew with boldness. He was unafraid to assume full responsibility for decisions, and he understood that initiative, determination to accomplish the task, and independence are vitally important in such a situation.

On the very first day after their arrival in Afghanistan, Gaynutdinov's crew flew a reconnaissance mission. But it was apparent that psychologically they had not yet adjusted from a noncombat environment. Spotting a group of armed men off to the side of their route (it was subsequently determined that these were dushman), the crew figured that it was hardly likely that they would start anything. The bandits, however, with little hesitation, proceeded to fire at the helicopter. Many instruments were knocked out of commission, and the hydraulic system and one of the fuel tanks were pierced by rounds. The helicopter began trailing a white stream of escaping fuel.

A worse predicament could not be imagined. Gaynutdinov immediately swung the aircraft around and headed for a safe area. This was the first time he had gotten into such a situation. As he later related, he had not felt fear. He had felt something else: regret that the crew might perish without having done anything significant to help the Afghan people. He saw that the only way out was to keep the craft in the air at all costs until he could reach a suitable landing site. He ordered the flight technician, Sr Lt Nikolay Koshelev, to keep a close watch on the gauges and report the slightest changes in functioning of the equipment, while he himself, together with the pilot-navigator, Sr Lt Marat Gizatullin, precisely sensing the behavior of the helicopter, continued to fly it away from the danger zone. Fortunately the powerplant continued to operate, and the aircraft responded to the controls. They succeeded in putting it down safely. The helicopter was back on the line within a few hours.

Vyacheslav Karibulovich, and all the rest of us as well, drew certain conclusions from that incident. We realized that the enemies of the April Revolution would make every effort to take vengeance on those who, following their internationalist duty, had come to give aid to the Afghan toilers, who were defending their own, people's rule. This meant that it was necessary to make thorough and comprehensive preparations for every flight, as if for a combat sortie. And the best guarantee against chance occurrences of any kind is rigorous consideration of the actual situation, boldness, and composure. Gaynutdinov demonstrated in a practical manner how excellent flying proficiency, solid moral-psychological conditioning, and excellent fighting qualities help in successfully accomplishing assigned missions.

(Lt Col V. Shcherbakov): In Afghanistan Vyacheslav Karibulovich and his crew carried out the most diversified missions. He flew into practically every



airfield here and traversed the entire country from north to south and west to east. He thoroughly studied the specific features of each completed flight, analyzed his actions in detail, and thought about how to proceed in various situations. And he would reach appropriate conclusions. A thoughtful individual, with an innovative approach to his job and with the ability to see the larger picture, Gaynutdinov noted many new things in matters of tactics. And he not only noted them, but would also be the first to put them into practice.

In the past, for example, we had not flown in mountains at altitudes close to our service ceiling, and carrying a load to boot. He was one of the first to master such flight configurations. At high ambient air temperatures, when the mercury rises beyond 40 degrees Celsius, there occurs an appreciable change in a helicopter's load lifting capacity and maneuverability. How should helicopters be operated in such heat, and how much load should be taken on board? Gaynutdinov was one of the first to find answers to these and other questions. He suggested many innovations pertaining to maintaining close coordination with ground troops subunits. He was able to achieve success first and foremost due to his excellent flying skills. The following incident is instructive.

Motorized riflemen had gone into the mountains on a combat training mission. They had taken along only the essentials -- weapons, ammunition, rations, and water. When they began to run short of supplies, they radioed for helicopter resupply. Gaynutdinov and his crew loaded their helicopter and headed for the mountains. There was no suitable landing site in the vicinity of their destination. The air was fairly thin, and the helicopter could not hold well in a hover. In this situation Gaynutdinov's virtuoso piloting skill came in handy! Precisely calculating his actions, he applied the brakes, touched down with his right main gear and nose wheel on a tiny piece of ground, and held the helicopter in this position until the supplies were unloaded.

He constantly shared his experience and know-how with the other pilots. Flight commander Vladimir Obolonin and senior pilot Capt Vladimir Korsakov learned many useful things from him. I must admit that he could also teach me a thing or two. Vyacheslav Karibulovich told us how to fly a helicopter in mountains at altitudes close to the service ceiling, at ground-hugging height, and taught us to calculate helicopter loading taking into account ambient air temperature, flight altitude and other characteristics. And how many times he warned us against mistakes which could cost a person his life! No, he did not call for excessive caution or avoid danger. On the contrary, he taught the pilots courage and bravery and the ability to make a decision based on thorough knowledge of the situation and sober calculation. And he provided practical reinforcement. Whatever difficult situations he found himself in, he always displayed the finest qualities of a military man.

In April 1980, by Ukase of the Presidium of the USSR Supreme Soviet, Gaynutdinov and I were among the first to be awarded the title Hero of the Soviet Union.



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Popular rule in the Democratic Republic of Afghanistan is becoming stronger with each passing day. Soviet servicemen are giving inestimable aid to that country's toilers in defending revolutionary achievements. Party member Military Pilot 1st Class Maj V. Gaynutdinov, who carried out his internationalist duty right up to the end, was one of them.

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#### FIGHTER PILOT-COMMISSAR REMEMBERED

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 11, Nov 84 (signed to press 3 Oct 84) pp 34-35

[Article, published under the heading "Years, People, Deeds," by twice Hero of the Soviet Union Lt Gen Avn V. Popkov and Maj (Ret) N. Kaplunovskiy: "The Commissar Led Them Into Battle"]

[Text] During the fighting on Kalinin Front our 5th Guards Fighter Regiment was temporarily deployed at a small field airstrip with forest on three sides. Spring was in full bloom. Following combat missions pilots would frequently take a walk in the birch wood. Filled with the aroma of spring, the forest air relaxed tensions.

Once battalion commissar Viktor Petrovich Rulin and several aviators walked over to a kolkhoz field, where some women and a boy about 14 years of age were resting alongside a freshly-plowed furrow. They greeted the pilots affably and told them that they were preparing to sow. The women treated the boy (the son of a soldier at the front, as the aviators later found out) deferentially, and called him boss, either in jest or in seriousness. And he replied to them in a quite serious and sober manner.

"All right, enough talking, back to work," the boy ordered. "Or else Petrovna will again chew us out or, even worse, will write dad."

At this point the pilots witnessed something unforgettable. The women proceeded to pull the plow along the furrow. The boy put his weight to the plow handles and kept repeating: "Easy does it, or you'll tire too fast...." Viktor Petrovich turned his head away and pulled out his handkerchief....

That evening the commissar gathered flight and ground personnel. His story stirred the men's emotions, striking a deep chord in their hearts.

"What conscientiousness a lad has who so guards his honor before his father!

The courage of our women and children! Can the enemy overcome our people? Never! I ask you to remember all this and to take vengeance on the fascists for our desecrated land, for the sufferings of the Soviet people," Rulin said in conclusion.

Aviation personnel literally forgot about sleep and rest those days. In the morning the ground technicians and mechanics inspected the fighters silently, without the usual joking. The pilots bent over the plotting boards, engrossed in studying the unfamiliar mission area, the battle line, and the patrol zone. Soon the airfield came alive with the roar of motors. The combat aircraft took off on a mission. Senior Lieutenant Bik-Mukhamedov, risking his life, rammed an Me-109 at a critical moment, helping his fellow soldiers brilliantly accomplish the assigned mission. This group downed an additional four enemy aircraft in this engagement.

Commissar V. Rulin flew several successful combat sorties. He was a truly gifted fighter pilot. He had received his baptism of fire in the battles against the Japanese militarists. He had been decorated. Viktor Petrovich flew the most critical and dangerous missions with V. Zaytsev, commander of the 5th Fighter Regiment, who subsequently was twice named Hero of the Soviet Union. Both were more than willing to devote time and effort to teach the young pilots and pass on to them their own experience and know-how.

The commissar thoroughly prepared for every mission. Possessing flawless knowledge of the equipment, he had the ability to take from the aircraft every bit of performance it had. Viktor Petrovich often conferred with the engineers and maintenance technicians on matters of engine and weapons maintenance. He observed while the ground crews adjusted the systems. He required that his men do the same. Alongside courage, the commissar prized in his pilots a striving toward knowledge and a hard-working nature, and he was unforgiving toward dishonesty and conceit. In one-on-one conversations he treated others as an equal, and for this reason the men would go to him with an open heart, taking an example from him in all things. Always measured and restrained, party member Rulin concerned himself with the emotional balance of his men and sought to ensure that they maintained an aggressive spirit. Talks and political rallies were regularly held in the regiment, wall newspapers were published, and amateur talent performances were organized.

It is no secret that every aviation engineer service supervisor wants a full maintenance crew to be working on each aircraft and wants the men to be fully work-loaded, for frequently aircraft would return badly shot-up. A good deal of work was required to get them back on the line. And here the commissar comes along and gives an order to release amateur performers -- maintenance technicians and mechanics -- for a rehearsal. People would think: just how appropriate are amateur entertainment performances when the fascists are on a push toward Moscow, and tomorrow we will once again be involved in intensive aerial combat, when the men are tired from constant stress and lack of sleep? But orders are orders. As it turned out, the men were able to handle the work on the aircraft with reduced numbers.

But how much joy and cheer these performances produced! War songs and lyric numbers, and verses by Soviet poets, calling to battle against the enemy sounded joyously and movingly from an improvised stage in the mess hall. The

amateur performers accompanied themselves on various musical instruments. It raised spirits and warmed everybody's heart. We gave our comrades long applause, and our hearts were filled with gratitude to such engineers of men's souls as the commissar. The men fought and worked even better.

Only once did we see Viktor Petrovich lose his composure. We were near Voronezh. The engineers and technicians had received orders to ready the aircraft immediately to proceed to another "point." The regimental engineer was releasing the final group of fighters, which included Rulin's aircraft. Viktor Petrovich helped him clamber behind the armor-plate seat backing and closed the aft inspection hatch. He fired up the engine and took off. His "passenger" felt very uncomfortable in the improvised cabin. Soon he caught sight of flack-burst puffs through the side glass, approaching the aircraft. The aircraft began to maneuver, and the engineer was pushed back and forth from skin to frame and back toward the tail cone. He had to expend a great deal of physical effort to hold himself in place. Suddenly the aircraft began to shake, and he smelled gunpowder. "Rulin is firing," the officer correctly guessed.

After the aircraft had landed and taxied to the flight line, the pilot jumped down onto the ground. He bent over, unbuckling his parachute. Straightening up, he happened to glance at the rear-view glass. The commissar, who had never flinched in the face of the enemy, turned pale! Viktor Petrovich opened the hatch with trembling hands, and did not recover his composure for quite some time: in the heat of battle he had forgotten about his comrade. It took the commissar an entire day to calm down.

Political worker Rulin led young pilots into battle many times. Upon spotting the enemy, he would attack first, wear him down by maneuvering and, after closing, would order his wingman to take over leader position and complete the attack. In this manner the young pilot had the opportunity to commit better to memory distance, closing speed, and angle of approach. In short, he would master those fighter pilot's basic procedures which made it possible to down an enemy aircraft with the first burst. Thanks to these lessons the newcomers became rapidly broken in and gained confidence.

...The war was rolling westward, toward the point from which the enemy had set foot on our soil. The Soviet Army was liberating one city after another. The Hitlerites were leaving behind cities, towns and villages reduced to rubble and ashes. And our aviators, landing on the next liberated airfield, were witnesses to the enemy's evil deeds. Viktor Petrovich Rulin made skillful use of these facts to instill in the men a burning hatred toward the enemy. When possible the command authorities endeavored to give what help they could to the inhabitants of the liberated areas.

I remember once near Kharkov a local resident came to our regiment. He introduced himself as a newly-elected kolkhoz chairman and turned to the commissar with a request for assistance. It was necessary to repair a tractor and an old one and a half ton truck, which were essential for farm work. Viktor Petrovich conferred with the aviation engineer service specialists. It was ascertained that truck driver Mochalov and engine mechanics Nazarenko and Kolodiy were familiar with the type truck and tractor in question. The



soldiers readily agreed to help the kolkhoz farmers. After completing servicing of the fighters, they headed for the village. And they did a fine job. It was heartwarming to see the people's joy and hear their words of gratitude to the soldiers. And the commissar most likely also remembered that boy with the plow and the women who had been plowing the field....

From that time forward we always gave assistance to the local populace when circumstances allowed.

Yes, we could say a great deal about our beloved commissar and his ability to fire the hearts of the aviators and inspire them to feats of valor.

By the time the war was over, Rulin had received the Order of the Red Banner four times. He was awarded many decorations. The commissar had logged more than 200 combat missions and was credited with several downed fascist fighters and bombers. He had killed considerable enemy personnel and had destroyed a good deal of enemy equipment.

Viktor Petrovich Rulin died recently. But he will live on forever in the memory of each and every one of us as a symbol of honor, valor, and great love for the homeland. The men of our guards regiment loved and deeply respected their commissar. He fought bravely against the fascist vultures and was not only a courageous fighter pilot but also a wise ideological mentor of our aviators, constantly concerned for his men, and he skillfully organized party-political work during those harsh days of struggle against the German-fascist invaders. Of course his job was a difficult one. Viktor Petrovich flew a great deal, often went on operational missions, skillfully conducted aerial combat, and frequently returned to his home field with a deserved victory. We were pleased with the victories of this intrepid commissar, proud of him, and sought to follow his example.

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#### SQUADRON MAINTENANCE CHIEF'S RESPONSIBILITY

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[Article, published under the heading "Marching in the Vanguard," by Col I. Svetlichnyy: "Personally Answerable"]

[Text] Aleksandr Fedorovich looked with embarrassment at the faces of the officers, enlisted men, and warrant officers, weathered by airfield winds. Standing before the formation of squadron aviation personnel, he felt uncomfortable under their curious gazes. The regimental deputy commander for aviation engineer service, aware of the officer's embarrassment and trying to lighten the official nature of the moment, stated simply: "Comrades, many of you are acquainted with Captain Zhurilko from previous duty assignments. He has now been named deputy commander of your squadron for aviation engineer service."

When the formation broke up, Zhurilko heard somebody say: "New chief.... For how long? "

Aleksandr Fedorovich looked around. A maintenance technician with thick reddish brows kept staring at him as if he was awaiting a reply. A thought flashed through the engineer's mind: "Did he perhaps not get along with his former superior? If so, why?" The unit deputy commander for aviation engineer service noted Zhurilko's embarrassment and said to him in a low voice: "Get close to the men, Aleksandr Fedorovich, and, most important, deal with them in a simple and straightforward manner. Maintenance technicians are straightforward people and like frankness. If you do not know something, do not be embarrassed to ask. Your predecessor had a difficult time of it. Frankly, he neglected individual indoctrination work. You have experienced flight technical maintenance unit chiefs and technicians in your subunit. Establish meaningful contact with them. Prove to them that you possess solid knowledge and experience."

These words from his older comrade calmed him down, and his spirits immediately improved. Aleksandr Fedorovich proceeded to walk with greater confidence down the flight line. He was also pleased that he had long been

acquainted with the squadron commander, Military Pilot 1st Class Lt Col A. Grishin. Zhurilko was confident that the latter would always support him and help at a difficult moment.

Busy with his thoughts, he did not notice that he had approached an aircraft under one of the wings of which that same maintenance technician who had made the caustic remark was working on the landing gear. Zhurilko squatted down next to him and asked in a most relaxed manner: "You're going to remove the wheel? How do you do it?"

The officer at first became flustered, apparently expecting an unpleasant conversation. He gazed expectantly at the engineer for a second, and then said in a businesslike tone of voice: "How to remove the wheel? No problem...."

And he calmly proceeded to describe the procedure.

...The first flight operations day. The weather was excellent. The camouflage-painted combat aircraft departed the field one after the other. From his command post the engineer watched them accelerate with a deafening roar and disappear into the boundless blue expanse of sky. The flight operations reminded Aleksandr Fedorovich of an event which had happened 10 years previously, when he, at the time a young aircraft maintenance technician in the Group of Soviet Forces in Germany, first took part in a tactical air exercise. He had worked with redoubled energy, but nevertheless did not avoid an unpleasant situation.

But while inspecting his aircraft during turnaround between sorties, Zhurilko discovered a problem. It was necessary to replace a piece of equipment immediately. The problem was, however, that there was clearly insufficient time to make the replacement without keeping the aircraft from flying a critical sortie. Two experienced maintenance technicians came to his assistance. Working smoothly in concert, they soon successfully completed the job. After the exercise he learned that help had arrived through the instructions of the squadron engineer, who had been closely monitoring his work. Incidentally, Aleksandr Fedorovich learned many useful things from this officer and subsequently endeavored to emulate him in every way.

...Suddenly Zhurilko heard over the speaker the voice of a pilot on takeoff: "Smoke in the cockpit...."

"What is causing it? What can it mean?" he asked himself anxiously. "Here is your first test, engineer! You must have forgotten to change something."

Soon, having completed his climbout, the pilot radioed that the smoke had disappeared. While the aircraft was in the air Zhurilko went through in his mind all possible causes of the smoke. When the aircraft landed, Aleksandr Fedorovich, accompanied by a ground maintenance technician and the flight technical maintenance unit chief, inspected the combat aircraft, but failed to find anything suspicious. This did not reassure him, however. The squadron engineer turned to his timeworn notes, but was unable to find an answer. Finally, late that evening, having gone over in his mind similar incidents

from his experience, he concluded that perhaps an overfilled fuel tank cap had not been tightly sealed, and fuel was able to be drawn out.... But for the time being this was only a hypothesis.

On the following day, immediately after formation, Zhurilko summoned the flight technical maintenance unit chief, Capt F. Ryabukha, and shared his hypotheses. He then said: "Fedor Petrovich, we must carefully, without hurting the officer's feelings, talk to the aircraft ground technician. For it might not be his fault either...."

Ryabukha nodded assent and was about to leave the officer when the ground technician in question appeared in the doorway. The flight technical maintenance unit chief left, leaving the officers alone.

"Comrade captain," the technician said, "Don't wrack your brains over what happened yesterday. The smoke in the cabin was my fault: I did not put the fuel tank filler cap back on straight. Kerosene was drawn out, and that caused the smoke. Later it stopped as the fuel was consumed."

He finished and looked expectantly at the squadron engineer.

"Well, let that be a lesson to you," Zhurilko replied in a stern voice. "I thank you for your candor. But why didn't you speak up immediately?"

The technician lowered his eyes: "To be honest, I was afraid of getting a dressing down. For so many years I have had a good record, and now...."

Aleksandr Fedorovich frowned: "You were afraid of getting chewed out? And I kept the aircraft grounded because the cause had not been determined.... Do you understand what a high degree of combat readiness means? That is the purpose of everything we do."

The young officer hesitated, an apologetic look on his face, and then said with firmness: "It will never happen again, comrade captain!"

Much time has passed since then. Today squadron deputy commander for AES [Aviation Engineer Service] Major Zhurilko warmly remembers his period of breaking-in with the subunit. He had been faced with various situations, and on every occasion knowledge and experience had come to his aid. Aleksandr Fedorovich has become a genuine leader, the principal technical mentor of the pilots and ground specialists. He regularly holds classes on airframe and powerplant theory and organizes cockpit training drills for the combat pilots. The main thing, about which he is always concerned, is that the aircraft be constantly ready to fly, as well as preventing preconditions for air mishaps.

...It was a regular flight operations shift. The air trembled from the roar of turbine engines. Flight operations were proceeding precisely on schedule. The equipment was operating flawlessly. The engineer was feeling relaxed. Suddenly a report came in: "The artificial horizon is not working on one of the aircraft."



Soon the combat aircraft taxied back to the ramp. Following flight operations Major Zhurilko personally inspected it. As it turned out, the pilot himself was to blame. Before taking off, he had failed fully to check operation of his artificial horizon. The squadron engineer discussed this incident in detail at the flight operations debriefing. After analyzing the error, he gave advice to the aviation personnel.

But all personnel do not always attend the debriefing and critique session: some of the men are on duty detail, and some are on leave. "How can an analysis of potential mishap-causing situations be communicated to all aviation specialists without exception?" Major Zhurilko thought to himself. And he concluded that a technical bulletin should be circulated within the squadron for each malfunction or mishap-potential situation. It could present in detail the results of flight operations, indicate the causes of deficient performances, examine them, and advise how to prevent air mishaps. Such a bulletin could be posted, immediately following flight operations, at the airfield or in the classroom where technical and flight personnel have classes.

Concerns.... Major Zhurilko has a great many. All work on the aircraft proceeds in full conformity with the work assignments specified by Zhurilko personally for each work day. But the squadron deputy commander for aviation engineer service notes from time to time certain, sometimes minor flaws in the work performance of his men. How should he proceed in such cases? Party member Zhurilko long ago adopted the rule of not ignoring even the slightest errors, for a small error of omission, if proper measures are not taken, can develop into a large mistake.

We must note for the sake of fairness that considerably more attention has been devoted to technical training of personnel since Aleksandr Fedorovich came to the squadron. Now such forms as group classroom activities, practice drills with the men on performing particularly critical operations on the aircraft, advance preparations and preflighting, as well as specific demonstration inspections are more fully utilized. But their degree of instructiveness, as we know, depends in large measure on correct assignment of maintenance specialists to critical areas, as well as their skillful mutual teamwork and coordination. There is food for thought here: dealing with utilization of test equipment, that work sequence which is most efficient for the current situation, and performance of operation-by-operation inspection. Incidentally, training corners have been set up in each flight thanks to the persistence and demandingness of Major Zhurilko, and the squadron has a training classroom containing display stands and diagrams of the various aircraft and engine systems. Major Zhurilko not only gives orders to and instructs his men, but also provides them with an example of conscientious performance of military duty.

"A knowledgeable specialist, a skilled educator, and a genuine activist," his

superiors say about him. "He is selfless in his work. If the situation requires, Zhurilko unfailingly accepts a large part of the work load and inspires the others. He stands personally answerable for the equipment and for the men working on it."

Aleksandr Fedorovich develops his men into skilled, strong-willed individuals of initiative, who show stick-to-itiveness in achieving the stated goal. Take, for example, aircraft technician Sr Lt V. Gaytanov. He does a fine job of performing his duties. The squadron deputy commander for AES assigned him, as a socialist competition leader, to experienced flight technical maintenance unit chief Capt M. Gilyazov, for on-the-job training in a higher position while still performing his regular duties, and advised him to determine for himself the timetable for mastering the new duties.

"You can always count on help and assistance," the major told him.

Zhurilko kept close watch on his subordinate's performance, gently advising him on how to teach the technicians and mechanics and how to establish purposeful and practical interrelations with them. He would unfailingly emphasize: "more demandingness! Combine teaching with indoctrination."

The time came when Captain Gilyazov reported that Senior Lieutenant Gaytanov had fully mastered the duties of flight technical maintenance unit chief. Thus the squadron deputy commander for AES now had another dependable candidate for promotion.

Party member Zhurilko has the ability to work with others. This officer uses practically tested and proven forms and methods of training and indoctrination. Aleksandr Fedorovich constantly seeks to develop inquisitiveness and innovative thinking in his subordinates. He pays particular attention to the young maintenance specialists.

...Lts S. Puzyrev and M. Makhmudov, recent service school graduates, arrived at the unit to report for duty. After his very first conversation with them Zhurilko determined that Puzyrev was better prepared in a practical manner, was more inquisitive and curious, but was arrogant. Makhmudov was the direct opposite. Together with experienced specialists flight technical maintenance unit chief Capt F. Ryabukha and aircraft maintenance technician Capt V. Polityko, Aleksandr Fedorovich assigned a job to each lieutenant. And when performance goals for the next phase of socialist competition were being specified in the squadron, he advised them what pledges to make.

The days of routine training went by quickly. Work on the aircraft alternated with classroom activities. The young officers tried hard. If difficulties were encountered, not only Ryabukha and Polityko but other experienced specialists as well were happy to help them. In time Puzyrev and Makhmudov kept their word: they began receiving no mark less than excellent for aircraft servicing procedures. The squadron commander commended the lieutenants. He cited them for successfully meeting their upgraded pledges.

Incidentally, well organized socialist competition in the subunit helps personnel achieve the heights of combat skill and perform job-related duties and maintenance on modern fighter-bombers with initiative, smoothly, and on

schedule. A profound, comprehensive analysis of successes and failures has become mandatory in this unit. Publicity and comparability of performance results are ensured. People know against whom they are measuring their performance. Each individual becomes permeated with a strong sense of personal responsibility for the state of affairs in the outfit and endeavors to maintain its honor.

This work style has become fundamental for all leader-Communists in the squadron. The commanding officer sets the tone. Lt Col A. Grishin always pays heed to the recommendations, counsel, and requests of his deputies A. Zhurilko, S. Aleksandrov, and V. Pitomets, the party buro members, and other activists. This has a positive effect on mutual relations in the outfit and improvement in the men's success in training and job performance.

Once Aleksandr Fedorovich complained to the commanding officer about the lack of experience on the part of the young men coming from service school, and he requested permission to hold technical personnel training conferences in the subunit.

"A worthwhile thing," Grishin replied, giving support to the idea. "We can also invite the young pilots to attend training sessions. This will be to their benefit."

Thus a fine tradition was born: to hold brief training conferences each month, at which senior comrades share their work experience with the younger men and give a practical demonstration of the sequence of inspecting aircraft and engine systems.

...It was a quiet evening in autumn. A pleasant freshness wafted in from the sea. There was still some time remaining before flight operations commenced, and Major Zhurilko headed toward the tower. Suddenly he halted in the middle of a taxiway and picked up a stone from the concrete surface. He tossed it in his hand. He thought to himself: "Engineer, you must also deal with these little stones." He recalled an article he had read in a technical journal, on damage to an operating engine caused by foreign objects. Aleksandr Fedorovich pulled out a notepad and jotted down: "Inform flight and ground personnel of the consequences of foreign objects entering an air intake." He then walked over to the aircraft where his men were working. The engineer's workday continued.

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## EFFICIENT GROUND CREWS IN FIGHTER-BOMBER SQUADRON

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[Article, published under the heading "Effectiveness and Efficiency to Competition," by Lt Col V. Basok: "Does the Leader Have Followers?"]

[Text] An integral part of the training and indoctrination process, socialist competition exerts favorable influence on all aspects of aviation personnel job-related activities. The desire to emulate the leaders, to follow their example arises and becomes strengthened in the process of military labor, in the course of efforts toward new achievements. Servicemen compete with one another in the air and at the airfield, in the classroom and when working on aircraft, seeking to achieve higher performance indices. I should like to relate how technical personnel and junior aviation specialists compete in one of our leading squadrons.

...Final preflighting preparations had been completed at the centralized fueling station, where the fighter-bombers were lined up in a row. Aircrews had received their preflight briefings. Soon green flares shot skyward, and the characteristic roar of starting engines immediately filled the air. The fighter-bomber squadron under the command of Military Pilot 1st Class Gds Lt Col V. Ryabinin proceeded to perform tactical air exercise missions. And they were not easy.

Following takeoff, the squadron proceeded en route in formations; the guardsmen subsequently delivered a strike without a pause against targets on an unfamiliar range and landed at a different airfield. A brief rest, preparation of the aircraft for another sortie -- and they once again took to the sky, heading for the range. The vanguard competition performers confirmed with deeds their leader position in the unit.

To be quite frank, on the eve of the tactical air exercise a troubling question gnawed away at the squadron commander: would the equipment and the men who serviced it let them down? After all, anything can happen during intensive flight operations: aircraft could fail to stand up under the work load, and some ground crewmen might simply lack the energy to pay close attention to the very end in readying the aircraft to go up. Therefore when the squadron deputy commander for aviation engineer service, Gds Maj R.



Khaliulin, reported the aircraft ready to go, Ryabinin asked him: What do you think, will everything go all right?"

"Certainly, comrade commander," Khaliulin smiled, and added: "After all, the flights primarily involved are those in which officers Blazun and Popolzin are the technical maintenance unit chiefs. As you know, they are old competition rivals, and although Blazun has taken the lead in the last few months, Popolzin is close behind. In other words, the ground maintenance specialists of these flights will not let us down."

There was no cause for the commanding officer's concern. At the tactical air exercise, just as during the entire training year, incidentally, the squadron's aviation personnel proved to be up to the job, accomplishing all assigned mock combat missions. And the aircraft performed flawlessly in the air.

An important role in the subunit's success was played by the aviation engineer service. Let us in our mind's eye visit the flight the technical maintenance unit chief of which is Specialist 1st Class Gds Sr Lt A. Blazun.

All the aircraft here have flown more hours than in the other flights, thanks to their trouble-free operation. No mishap-potential situations occur through the fault of the men. Hence the fine results. Based on principal performance indices, this outfit is a solid leader in socialist competition in the squadron.

How do the ground maintenance specialists succeed in holding their leadership position in the campaign for a further increase in combat proficiency and reliability of aircraft operation? First and foremost by good organization of the training and indoctrination process in the flight and by high-quality preflight preparation of the fighter-bombers. The principal form of technical training of the ground maintenance specialists consists of individual training assignments and practice drills directly on the combat aircraft. Gds Sr Lt A. Blazun gives an assignment to each of his men and checks to make sure that it is completed on schedule.

The flight technical maintenance unit chief also has his own methodological devices. For example, he devotes more attention to practice drills as one of the forms of technical training than to other forms, correctly maintaining that in practice drills aviation personnel do not simply rehearse or reinforce certain actions. Emphasis is placed primarily on thoroughly understanding the operations which are being performed. At the same time some other practice drills are conducted for the purpose of preventing aircraft equipment breakdowns or malfunctions. For example, the following incident once occurred in the neighboring squadron: the drag chute popped out while an aircraft was on its takeoff roll. This was due to a ground crewman's faulty latching of the container in preflighting the aircraft. Officer Blazun decided to conduct a drill with his men. First he demonstrated how to close the latch properly, and then each ground crewman performed the operation while he observed.

Another incident occurred in the flight in which Gds Capt V. Popolzin is technical maintenance unit chief. During intensive flight operations mechanic

Gds WO A. Tishchenko topped off an external fuel tank and reported the operation completed. When the pilot started his engine, however, fuel proceeded to leak out from under the filler cap. Naturally the flight was delayed. It was determined that the mechanic had incorrectly closed the cap on the fuel tank. Learning about this, Gds Sr Lt A. Blazun held a practice drill with the ground crewmen of his flight on correctly securing an external fuel tank filler cap.

The following question may arise: was it really necessary to hold practice drills both in the first and the second instance? After all, it is a fairly simple matter to communicate to personnel the mistakes made by other ground crewmen. The majority of flight technical maintenance unit chiefs do precisely that. Officer Blazun, however, in spite of the fact that each of his men had on many occasions packed and latched the drag chute and had fueled an external tank, nevertheless held the practice drill. This is not some whim on the part of the flight technical maintenance unit chief. He firmly adheres to the following rule: one can also learn from the mistakes of others. In addition, the simpler, more easily understood and familiar an operation, the less attention a ground crewman pays it. Thus mistakes are most probable in performing precisely such an operation. As we know, there are no simple or complex jobs on a modern aircraft; everything must be performed with equal effort.

Now let us take such a matter as preflighting an aircraft. Blazun is constantly concerned with accomplishing the entire job as quickly as possible (but not to the detriment of quality). And he often finds optimal variations for accomplishing tasks. Three of the flight's aircraft, for example, are going to fly with externally-mounted tanks. As we know, it takes time to check them for leaks and verify that they are full. But where does one obtain this time, when everything is so tightly timetabled? Here too the flight technical maintenance unit chief finds a solution: take mechanics off aircraft which are not going out with external tanks and assign them to ready aircraft which are. With this procedure the aircraft are readied more quickly.

One must also give due credit to mutual understanding in the flight. Aircraft technicians Gds Capt A. Tikhomirov, Gds Sr Lts G. Popov and S. Khlebnikov, aircraft mechanic Gds WO Kh. Baychelov and others understand the flight technical maintenance unit chief literally with half a word spoken. At the same time they can always count on his assistance and counsel. The men work hard, with a full awareness of their responsibility for the assigned task.

Now let us become better acquainted with the leader's rivals. In the flight in which Gds Capt V. Popolzin is technical maintenance unit chief the ground maintenance specialists are also strong performers. Aircraft technician Gds Lt A. Barsukov, for example, works not only knowledgeably but also with energy. Mechanic Gds WO L. Dubovskiy is master proficiency-rated, the pride not only of the flight but of the entire squadron as well. His fellow soldiers say about him: "Dubovskiy always looks for work to do on the aircraft and always finds it." And if it is necessary, he will not leave the airfield until he has finished the job. Other ground crewmen are also deserving of praise. As a result, although the aircraft are identical in the two flights, the men are well trained, diligent, and understand their job. Nevertheless

Gds Sr Lt A. Blazun's men are more successful. In our opinion the "secret" lies first and foremost in the team's degree of organization, which their neighbors are sometimes lacking.

Here is an example. On the aircraft of Gds Sr Lt Ye. Fisher, mechanics discovered a poor seal on a hydraulic accumulator diaphragm. Popolzin ordered that it be replaced, without inquiring whether the aircraft technician had ever performed this procedure. As it turns out, he had not. But orders are orders! And the officer, in order to remove the hydraulic accumulator, proceeded to unscrew everything that would unscrew. One hour, and then another hour went by. The job was proceeding, although slowly. Gds Maj R. Khaliulin approached the aircraft and asked what the technician was doing.

"I am removing the hydraulic accumulator. I am going to change the diaphragm," the senior lieutenant replied.

The squadron deputy commander for aviation engineer service was surprised: "Why remove it? Unscrew the top, pull out the diaphragm and replace it. It takes only a minute!"

Thus because the flight technical maintenance unit chief, after giving the aircraft technician instructions to correct the problem, did not tell him how the procedure should be performed, several hours were wasted. It is highly unlikely that Blazun would have done something like that. The difference in organization of the labor of these officers' men is all too evident.

We should note that we are talking about strong-performing outfits. As we see, however, they too have unutilized reserve potential. All Popolzin has to do, for example, is to take a closer look at Blazun's experience and know-how in the area of organizing aircraft preparation or training, and his men's performances could improve. I am sure that there is untapped reserve potential in other outfits as well. If the desire is there, this reserve potential can give them considerable assistance on the road to leading performance.

Guards Major Khaliulin, together with the flight technical maintenance unit chiefs, does a great deal to ensure reliable aircraft operation in the air. Much importance in the subunit is attached to checking aircraft readiness for flight operations and analysis of problems, in order to devise specific measures to prevent them.

The squadron's aviation engineer service specialists are working to reveal additional reserve potential for improving the quality of readying the fighter-bombers for flight operations, for ensuring reliability in the operation of all aircraft systems and equipment and, consequently, flight safety. As regards organization of socialist competition, one can state with confidence that the leaders here have followers.

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## PREDICTING PILOT MANEUVER ERRORS WITH MATHEMATICAL MODELS

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 11, Nov 84 (signed to press 3 Oct 84) pp 39-40

[Article, published under the heading "The Reader Continues the Discussion," by Military Pilot-Instructor 1st Class Lt Col N. Litvinchuk: "Models Are Needed Not Only in Tactics"]

[Text] In the article "Are Models Needed in Tactics?" (AVIATSIYA I KOSMONAVTIKA, No 9, 1983) the authors raised a subject the relevance of which is unquestioned, since improvement in the methods of training combat pilots is a continuous process which is becoming steadily more complex as aircraft become more sophisticated. I believe, however, that modeling is acceptable not only in tactics but also in mastering flying techniques by pilot cadets. The ability effectively to utilize modeling does not come automatically. Mastering of this method requires persistence both during the initial period of familiarization and later as well.

As we know, the principal task of preflight training is to develop on the ground flying skills and abilities which, during practical training in the air, become skills connected with the entire aggregate of flight sensations. This makes it possible to reduce costs and shorten time required for training a pilot, and in addition promotes development of pilot initiative and a striving toward innovation.

On the other hand, during extended flights under identical conditions, especially if flying habits and skills were acquired in the process of so-called rote drill, the student pilot develops a strong link with the environment in which they were practiced. And this means that an unexpected change in flight conditions, aircraft stability and control characteristics, as well as other factors can cause errors. In my opinion one can estimate what errors will occur, as well as their qualitative and quantitative characteristics with the aid of simulation. It becomes possible to determine the effect of change in conditions on the overall quality of flight operations (for an entire flight operations shift, for example) and to predict to some degree how a pilot should individually "adjust" already developed habits to new flight conditions in relation to situation change.



In this article we shall examine modeling of functioning of the "pilot-aircraft-environment" system taking into account developed habits and skills. For example, a pilot has acquired skills in flying an aircraft of one type under certain conditions, and subsequently these conditions changed or he had to requalify on an aircraft of a different type. What is observed here? We shall examine modeling stage by stage.

The pilot flew for an extended period of time with low ambient air temperatures. It is necessary to estimate how a sharp increase in temperature will affect the quality of takeoffs and landings if wind direction and velocity are the same in both instances.

We know that at a given indicated airspeed an increase in ambient air temperature leads to an increase in true airspeed, to decreased engine thrust, and consequently to slower acceleration on the takeoff roll and to an increase in length and duration of takeoff roll. The pilot's sense of time plays an important role during takeoff. Proceeding from this, it is not difficult to show that the principal error, especially on aircraft with a low thrust-to-weight ratio, will be an attempt to raise the nose wheel and lift off the runway prematurely ("pulling" the aircraft into flight). One can determine the expected airspeed with the following formula:

$$V_{l\text{nw}}(\text{lift}) = V_{\text{sp.nw}}(\text{lift}) \times \gamma_{\text{max1}}/\gamma_{\text{max}},$$

where  $V_{l\text{nw}}(\text{lift})$  -- calculated airspeed, lift nose wheel (liftoff);  
 $V_{\text{sp.nw}}(\text{lift})$  -- specified airspeed, lift nose wheel (liftoff);  
 $\gamma_{\text{max1}}$  -- acceleration on takeoff roll in conditions of elevated ambient air temperature;  
 $\gamma_{\text{max}}$  -- aircraft acceleration on takeoff roll with which takeoff procedure skills were acquired.

As we know from flight psychology, on the landing approach distance to the ground is estimated from the sheaf of separation of ground points and the angular velocity of displacement of the ground surface. They depend on aircraft speed, height of the pilot's eyes above the ground surface, angle of the pilot's gaze and distance to the point at which it is directed. With the assumption that in new conditions the pilot will attempt to maintain the specified height at check points, on the basis of his current skill in determining height by rate of angular motion and equating these rates for the two conditions, one can estimate expected height error.

Overshoot or landing at elevated airspeed (at a small landing angle) will evidently be another typical error with a sharp increase in temperature. In this instance it is not difficult to calculate the amount of overshoot or landing angle.

Let us consider another example. For a certain period of time flying was done in bad weather and with poor visibility. We shall attempt to estimate how VFR conditions with excellent visibility will affect the quality of pilot performance.

A person's work efficiency and degree of error-free performance depend on the degree of stress or tension. As tension increases, accuracy of performance initially increases, reaching a maximum, and then commences to decline. One can assume that on extended flights under identical conditions moderate tension will correspond to some stable value. Naturally a pilot's tension decreases with a sharp improvement in conditions, and consequently his sharpness of attention diminishes, which in turn can lead to a decrease in quality of piloting and an increased number of errors, and diminished external visual observation. One should also expect errors in maintaining flight parameters, connected with distortions in the pilot's gauging of distances. In order to make a precise estimate of decrease in flight safety one must know how various conditions affect tension during flight and to what degree it is connected with faulty performance by each pilot. This is no easy task. Therefore during a period of abrupt change in conditions experienced commanders explain to flight personnel the peculiarities of this phenomenon and increase demandingness on quality of piloting and maintaining visual attentiveness.

Many fine points also arise when a pilot is requalifying on a new type of aircraft, nuances which must be taken into consideration. For example, it is quite easy to calculate the extent to which the angular rate of a roll executed on the new aircraft will differ if its execution is based on the skill as practiced on the previous aircraft:

$$\omega_2 = P \omega_1 / P \omega_2 \times \omega_{sp},$$

where  $\omega_2$  -- expected angular rate when executing a roll on the new aircraft;  $P \omega_1, 2$  -- lateral controllability characteristics of the aircraft;  $\omega_{sp}$  -- angular rate of roll executed on already-mastered aircraft.

The process of modeling the functioning of the "pilot-aircraft-environment" system in various conditions requires certain knowledge of aerodynamics, dynamics of flight, engineering psychology, and other specialized subjects which every commander-educator has mastered. Therefore it is not difficult to incorporate the modeling method into the process of pilot cadet training.

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## FUNCTIONS OF GARRISON WOMEN'S COUNCIL DISCUSSED

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 11, Nov 84 (signed to press 3 Oct 84) pp 40-41

[Article, published under the heading "The Reader Continues the Discussion," by Maj (Res) V. Trifonov: "Right to Respect (From the Working Experience of an Aviation Regiment Women's Council)"]

[Text] I have been closely following the discussion on the topic "The Family and Work in Aviation" in this journal. It is a very important subject. I am deeply convinced that family relations affect not only the job performance of aviation personnel. Most married officers and warrant officers have children. Conditions for a child's comprehensive, harmonious development are created precisely in the family, and in the family the foundation is laid on which is formed and shaped the citizen of our great nation.

In the article "We Have Common Concerns" (AVIATSIYA I KOSMONAVTIKA, No 5, 1984), Viktor and Svetlana Bykov stated that establishment of an atmosphere of love and friendship, mutual respect and sensitivity in the family depends first and foremost on the spouses themselves. All this is true. It seems to me, however, that the Soviet family's organic link with society has always been a distinctive feature of the family's practical educational function.

Recently links between the family, non-school educational establishments, schools, and the military collective have been growing ever stronger. This is why, when discussing the family, one cannot help but address the question of relations which form between command authorities, political agencies and public organizations, in particular the women's council, which is called upon to assist commanding officers and political workers in the matter of increasing the combat readiness of military units. I would like to discuss the work experience of the women's council of the aviation regiment in which I served for quite some time.

Soon after the election of Al'bina Nikolayevna Koroleva as chairman of the unit women's council, she happened to be witness to a conversation which offered her considerable food for thought. A tall, attractive woman was complaining to a female acquaintance that she still was unable to find a job in her field of specialization. Her husband was sympathetic, telling her she should not give up, but that did not make things any better.

"Things are also hard for Volodya and me," her acquaintance replied. "I would like to get Aleshka into kindergarten and get a job. Do you think we should talk to the women's council?"

"I have no faith, Ol'ga, in these women's councils. This is the second garrison I have lived in. I have gone to them for assistance. They listen to what you have to say, give promises, and that's as far as it goes."

Al'bina Nikolayevna grasped the main point of this conversation: the women's council here does not enjoy respect or prestige. This is what happens when it fails to give specific assistance to the wives of military personnel in matters pertaining to finding them jobs, enrolling their children in kindergarten, helping resolve family strife, and fails to help out in other difficult situations. But how can this trust be earned? In the garrison from which Al'bina Nikolayevna had recently come, she had served for three years as women's council chairman. She recalled her first days on the job. Things were difficult. Family, job, volunteer activities.... And time had to be found for all of this. Of course it would be easy and simple to avoid facing difficult questions. But it was precisely successful resolution of such questions which in the final analysis always exerted a beneficial influence on accomplishment of combat and political training tasks by the regiment and ship-free flight operations. It is obvious that if there are no problems at home, a pilot, navigator, engineer, or technician is in a better mood on the job, and work proceeds smoothly. But when things at home are bad -- it is time to be concerned.

...Igor' and Ol'ga Chistov, in a depressed state, returned home in silence from a festive evening at the unit club. And yet things had begun so nicely....

At the festive gathering the unit commanding officer had presented to aircraft electronics maintenance group chief Senior Lieutenant Chistov a valuable gift for excellent results achieved in combat and political training. The Chistovs had taken part in a holiday concert. Igor' had played in the orchestra, and Ol'ga had read some new poems she had written. They were applauded by the standing-room-only audience, and their friends had offered congratulations, saying many nice things. But while Igor' modestly remained silent, Ol'ga accepted everything as her due. In addition, closely scrutinizing her husband's friends, and especially their wives (how they were dressed, how they behaved), she stated her opinion with unconcealed sarcasm. Igor' tried to treat her words as a joke, but everybody's mood was hopelessly ruined.

"Why is Ol'ga so haughty?" he asked himself. Where does she get this? Yes, she had been born and raised in the capital, in an affluent family. It was not easy for her to bid farewell to her parents, her girl friends, and her accustomed milieu and travel to her husband, who was stationed at a distant steppe garrison, where it is not easy to create living conditions equal to those in the city. And of course it was difficult for her to give up these simple earthly joys -- wearing pretty clothes, going to the theater and attending concerts.... But that is no reason for insulting people!



Some time later the same kind of thing happened at a birthday party for one of Igor's colleagues. People began to avoid the Chistovs. Igor' tried to talk to his wife and convince her how important tactfulness, a kind word, attentiveness, and involvement are in human relations. But his words had no effect.

"It's either me or your friends," replied Ol'ga, offended.

Externally nothing had changed in their home. When Igor' returned from the airfield, a nicely prepared supper, freshly-pressed clothes to change into, and a clean, neat apartment would be waiting for him. But the main thing was lacking -- harmony and mutual understanding. Sometimes they would go for days without talking. The lack of harmony was very hard on Igor'. He wanted so badly for his wife to smile kindly and to ask about his work, his concerns, and his friends. Even problems and disappointments would not seem so overwhelming. And problems on the job did soon appear. He was put on report for the first time in his 9 years in the service.

Here is what happened. Upset by the problems at home and almost constantly in a depressed state, Chistov began to pay less attention to his men's work. As a consequence one of the warrant officers, when readying an aircraft to go out again, failed to change the com frequencies, which practically resulted in a failed mission.

Igor' was in an agitated state. Upon returning home from the airfield, he would sit down to study (he was enrolled in a higher aviation school correspondence faculty), but was unable to concentrate. He finally decided to have a talk with Maj V. Meshcheryakov. They lived in the same building and often would play chess together in the evenings. Vladimir Ivanovich's colleagues respected him for his good sense and responsiveness. Igor' told him about the problem in his family, and a few days after this conversation left to attend a conference.

Vladimir Ivanovich decided to speak to Mrs Koroleva about the matter. He realized that the chairman of the women's council could better help the Chistov family -- it would be easier for her to communicate with the young woman. Al'bina Nikolayevna listened attentively to Meshcheryakov, and then said: "You can count on me, Vladimir Ivanovich. I think everything will be all right." And she added: "We are partly to blame for the fact that young married couples are unable to handle their mutual relations. We are at present devoting little attention to this matter...."

Her first conversation with Ol'ga was unsuccessful. Koroleva was prepared for this. Soon thereafter she saw Mrs Chistov by the club, where a new film was being shown. The young woman wanted to see the movie, but she had nobody to leave her daughter with. Al'bina Nikolayevna offered to take care of the little girl. Ol'ga gratefully accepted the offer. On several occasions after that she also stayed with Irin'ka when her mother had to go to town to do shopping. Soon she invited her to visit.

With such genuine solicitude she gradually established a friendly relationship, and prepared herself for a conversation on the main subject. They soon had that conversation -- difficult, but open and truthful. Ol'ga perhaps for the first time gave some serious thought to her relationship with her husband, his comrades and colleagues.

Koroleva conferred with the regimental deputy commander for political affairs on how to help Mrs Chistov find employment. The two of them asked the director of the kindergarten to take the girl on, explaining the reason. Ol'ga was already working when her husband returned, and Irina was enrolled in kindergarten. Peace and harmony were restored in the Chistov family.

And Koroleva came to a realization: the right to trust and confidence does not come along with a job appointment; it must be earned.

Commencing her job as women's council chairman at the new garrison, Al'bina Nikolayevna was aware that it was necessary first of all to gain more respect for the elective organization. Few persons attended the first meeting of wives of military personnel. The members of the women's council listened to what the women had to say and took down their requests and suggestions. They gave nobody any solid promises, but they asked that trust be given to the women's council and that it be helped in the initial stages.

Koroleva and her assistants Svetlana Zakharova, Tat'yana Sadikova, Natal'ya Oberyukhtina, Mariya Bezmenova, Vera Zelentsova and others, for the most part teachers by training, contacted the managers of enterprises in the town on the outskirts of which the garrison was located, as well as the rayon department of public education, and learned of possible job vacancies. They added to the women's council the wife of a serviceman and an inspector in the rayon department of the militia, Lt N. Oberyukhtina, to work with difficult teenagers. At a meeting with the regimental commander it was decided to institute a young people's oversight position at the garrison housing administration. Soon activists began making the rounds of the military post after 9 p.m., checking to make sure that adolescents were not idly hanging around in the building entrances and vacant lots.

It of course took some time to get the women's council operating at full steam, and things were not an unmitigated success right at the outset. Alesha's mother had to be on the waiting list to place her son in kindergarten, but she did not appeal in vain for help to the women's council. And a job in town was soon found for her acquaintance, Tamara -- she was able to find employment in her area of specialization.

Time passed. More and more wives of military personnel were going to the women's council with their problems and for assistance. Once officer's wife Raisa Chepenko, a stomatologist, came to Koroleva to ask for help in finding employment. There was a vacant spot in the medical unit, but a specialist from town had applied for it. Al'bina Nikolayevna went to the regimental deputy commander for political affairs and to the garrison medical service chief. Making reference to the regulation prescribing that preference shall be given to the members of the families of military personnel in garrison hiring, she succeeded in convincing them she was right.

Respect for the elective organization gradually grew. Once a warrant officer received a disabling injury in an accident and was discharged into the reserves. His family was living in a private apartment. Of course housing was tight both at the garrison and in town. Nevertheless the regimental command authorities and the members of the women's council began working hard to find a solution to the situation. The problem was eventually resolved: the warrant officer's family was assigned an apartment. Confidence in and respect for the women's council on the part of the regimental command authorities and the families of military personnel buoyed the spirits of Koroleva and her assistants, infused them with new energy, and made them want to work even harder.

Once, after watching the regular television broadcast of the Moskvichka Club, the members of the women's council exchanged views and decided to hold a special evening event. The town couturier establishment displayed its latest fashions, hairdressers demonstrated popular hair styles, while culinary specialists and confectioners presented table layouts and pastry displays. The evening was a success.

The members of the women's council displayed inventiveness and originality in preparing for celebrating New Year's Eve and school vacations. The children of military personnel took part in various contests, competitions, in field trips to the regional studies museum, and attended the circus. A trip to Moscow brought a great deal of joy to the upper-graders.

The range of matters being successfully addressed by the women's council is expanding day by day. At the council's initiative a medical cosmetologist is now available at the garrison, and a health group has been organized, with which officer's wife Vera Zelentsova, a category-rated athlete and member of the women's council, is working on a volunteer basis. An inspector from the militia children's room presents parents lectures on bringing up children. Model aircraft building and knitting groups meet regularly. Recently the women's council organized a tour of inspection to check the state of sanitation and hygiene in apartments with shared kitchens. First place was awarded to the apartment in which the family of officer Sarayev resides. Family members now pay frequent visits to the airfield and the combat glory museum. Wives and children see their husbands and fathers at work. This helps them better understand and grasp the significance and necessity of their difficult military labor.

The members of the women's council have made it a rule to become acquainted with families newly arrived at the garrison. In their conversations they determine the career specialization of the wives of military personnel, their interests and hobbies, their children's ability in school, and their state of health. They relate the regiment's traditions to the newcomers.

This unit's women's council is doing a good job. It is giving the command authorities appreciable assistance in accomplishing combat and political training tasks. A great deal can be done even in such a small garrison if effort is applied and initiative is displayed in the interests of the main goal -- strengthening of the unit's combat readiness, increasing the

cohesiveness of the collective, and educating military personnel and the members of their families.

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## WEST ACCUSED OF WARMONGERING

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 11, Nov 84 (signed to press 3 Oct 84) pp 42-43

[Article, published under the heading "Imperialism -- Enemy of Peoples," by Candidate of Philosophical Sciences Col E. Korsakov: "He Who Sows the Wind...."]

[Text] The instigators of a policy of confrontation, an arms race, and achievement of military superiority are pouring torrents of slander against the USSR, attempting to argue that the threat to peace emanates from the Soviet Union and that the West is merely responding to this challenge. Why is this being done? Primarily for the purpose of confusing public opinion in regard to their own militarist preparations, to provide justification for their own policy regarding the arms race, and to weaken the peace movement.

Aggressiveness, aspirations of expansion and hegemony, that is, to seize the land and wealth of others, and toward unrestricted economic and political domination proceed from the very nature of imperialism. V. I. Lenin wrote: "A monopoly, once it has formed and controls billions, with absolute inevitability permeates all aspects of societal affairs, regardless of political system or any other 'particularities'."

While imperialism's need to take the path of violence in achieving its selfish interests and goals of enrichment proceeds from its economic nature, politically, and V. I. Lenin noted this, imperialism is basically a striving toward violence and reaction. This finds expression in the wars and armed conflicts to which imperialist nations resort for the purpose of establishing domination over individual areas or entire regions of the world. The ultimate embodiment of such actions is a striving toward world domination by the most aggressive, adventurist imperialist circles. Such a policy led to the two world wars, which claimed more than 70 million human lives.

The increased aggressiveness and militarism in the capitalist countries at the end of the 1970's and beginning of the 1980's is due primarily to the class reaction of imperialism to the shifted world balance of power in favor of socialism and, as a consequence, to international detente. The most reactionary forces are seeking to overcome the internal conflicts evoked by profound economic crisis through the path of militarization and military

adventures, dumping the consequences of this crisis onto the shoulders of the people. Attesting to this in particular are the results of the April meeting of the NATO Nuclear Planning Group.

The increasing aggressiveness of imperialism and growth of militarism in the capitalist countries are manifested in various directions. We shall state the most important of these.

First and foremost it is a policy aimed at tipping the balance of military-strategic parity between the United States and the USSR, between NATO and the Warsaw Pact. An unprecedented growth of military expenditures attests to the aggressiveness of imperialism. In the period 1981-1985, for example, U.S. expenditures on military preparations will increase by a factor of more than 2.2. The military expenditures of Great Britain, the FRG, France, Italy, Japan, and other capitalist countries are growing.

Modern means of waging war are being designed and built and new war plans devised in the imperialist countries, especially by the members of the NATO bloc. The Pentagon's programs call for building more than 12,000 cruise missiles of all basing modes. There is already a squadron of U.S. B-52 bombers armed with cruise missiles.

U.S. ruling circles do not conceal their intentions regarding preparing for and unleashing a thermonuclear world war. But at the same time they talk of peace, assuring the world community of their noble intentions. The U.S. secretary of state, for example, loudly asserts the present administration's aspirations for peace. To quote him, however, this peace should be grounded on strength. Thus he justifies the largest rearmament program in the history of the United States, aimed at attempting to achieve military superiority and, as the strategists across the ocean dream, at preserving this military superiority up to the beginning of the third millennium. Persistent efforts are being made to foist on the public the notion of the alleged defensive nature of NATO military preparations, and they try to suggest that the more powerful NATO becomes, the more tractable the Warsaw Pact will be.

What grand doctrines are born in the inflamed imagination of the strategists across the sea in their impossible scheme to gain the upper hand in a nuclear clash: "limited nuclear war," "prolonged nuclear conflict," and "nuclear first strike." The United States is currently working at an accelerated pace on development of new types of weapons, including neutron, chemical, and bacteriological. An important role is assigned to a program to militarize space.

But against whom is the United States planning to use this lethal arsenal? Primarily against the Soviet Union. At the end of the 1970's the United States proceeded to intensify its hostile policy toward the USSR and the entire socialist community and to make frank claims to a leadership role in the world and armed intervention in the internal affairs of other countries. A most important component of this policy is the "new nuclear strategy" announced by Presidential Directive 59. This strategy, as well as the concept of "prolonged nuclear war" constitute an expression of imperialist plans to unleash a nuclear world war.

At the beginning of 1983 the U.S. President announced another strategic concept -- the so-called concept of power defense. It essentially consists in developing an American superweapon which will be capable of destroying the missiles of the potential adversary before they reach U.S. soil.

The United States maintains military bases in various parts of the world. The purpose of "base strategy" is to prepare favorable conditions for initiation and conduct of war against the Soviet Union, to hold the Soviet Union and the other socialist countries under a threat of nuclear attack. The United States has deployed approximately 2,500 different military bases and installations, including 400 large bases and installations in 144 (!) different countries. Hundreds of U.S. military bases are situated along the borders of the Soviet Union. More than 500,000 U.S. officers and men are stationed abroad, and approximately one third of the U.S. nuclear potential is deployed abroad -- 12,000 warheads, about 7,000 of these in Western Europe, 1,800 in Asia, and 2,500-2,800 on warships deployed on the oceans and seas.

U.S. intermediate-range missiles are deployed in the FRG, Great Britain, and Italy. Thus the appearance of U.S. Pershing and cruise missiles on the European continent is becoming a fait accompli. They are not at all intended for the defense of Western Europe which, incidentally, nobody is threatening. Their deployment pursues a single objective: to ensure superiority of the NATO bloc over the countries of the Warsaw Pact and to place the Soviet Union under an even greater threat of nuclear attack.

Contrary to the facts of history, the troubadours of war and aggression spin a yarn to the effect that the ruling circles and governments of the NATO countries are guided in their foreign policy by lofty "moral principles" and seek to "protect the rights and interests" of peoples. In actual fact, however, sharp conflict situations have arisen in various parts of the world precisely due to the aggressive policy of imperialism: in the Near East, in Southern Africa and on the Horn of Africa, in the South Atlantic, in Central America and the Caribbean. The Near Eastern crisis, caused by the aggressive policy of Israel, under the wardship of the United States, is of a particularly protracted and unhealthy nature.

In the postwar years imperialism has unleashed a series of local wars which, to quote V. I. Lenin, are a continuation of the imperialist policy of conquests, extirmination of entire ethnic groups, and unprecedented atrocities. According to figures in the U.S. press, the United States has employed military force to achieve its foreign policy objectives at least 767 times since World War II. A total of 150 armed conflicts have flared up in various parts of the world through the fault of imperialism since 1945. They have claimed 25 million lives, that is, a number equal to half of the total number of persons who perished in World War II. Local wars and conflicts are also dangerous in that they could escalate into a nuclear war. According to the figures of the Brookings Institution, for example, just in the period 1946-1975 the United States was on the brink of employing nuclear weapons on 19 separate occasions.

The peoples of the entire world hold up to shame the U.S. military invasion of Grenada and condemn this act of outrageous brigandage and crude challenge to mankind's aspiration for peace. Reagan's "gunboat diplomacy" is also directed against Nicaragua and other peace-loving countries and peoples.

The United States has established "rapid deployment forces" to prepare for and conduct local wars. Their strength level exceeds 200,000 men. The Reagan Administration, however, intends to double their strength in the near future.

The imperialist nations are also creating an explosive situation in various regions of the world by supplying arms to antipopular regimes. The administration in the White House endeavors to support any country which, in its arbitrary definition, is a "bastion against communism." In El Salvador, for example, in the last 3 years the fascistic troops which are supported by U.S. dollars have killed more than 40,000 persons. The Israeli invaders are committing acts of aggression and genocide on the soil of Lebanon and other countries of the Near East with weapons supplied by the United States and other NATO countries. Counterrevolutionary bands of former Somoza supporters are invading Nicaragua on a growing scale, bands which are directed, trained, and supplied by the United States.

Thus the facts convincingly demonstrate that the nature of imperialism remains unchanged. Maintaining its aggressive nature, it continues to be a source of wars and military danger, and its policies present a genuine threat to international security. The only possible response to this policy is increased vigilance on the part of peace-loving nations and peoples and a high degree of combat readiness on the part of the Soviet Armed Forces and the armies of the Warsaw Pact nations. A reply to those who are sowing the wind was given by CPSU Central Committee General Secretary Comrade K. U. Chernenko, chairman of the Presidium of the USSR Supreme Soviet, at a get-together with the voters of Moscow's Kuybyshevskiy Electoral District: "And let all know that no fanciers of military adventures will succeed in taking us by surprise, that no potential aggressor can hope to avoid a devastating retaliatory strike."

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## EFFECTIVENESS OF LASER-GUIDED BOMBS ANALYZED

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[Article, published under the heading "Abroad," by N. Novitskov, engineer: "Bombs Guided by a Laser"; based on materials published in the foreign press]

[Text] The foreign press, when discussing the experience of air combat operations in local wars in Southeast Asia, the Near East and in the South Atlantic, notes the steadily increasing effectiveness of air defense weapons. During the war in Southeast Asia, for example, U.S. air forces lost a total of about 7,000 aircraft. The air defense system deployed in the DRV forced the U.S. command authorities to utilize more than 25 percent of the total number of combat sorties to neutralize air defense and an equal number for the conduct of electronic warfare and to escort strike forces. As is noted by foreign experts, only 50 percent of U.S. aircraft conducted basic operations. As a result, there was a substantial decrease in the forces designated to hit ground targets.

When bombardment of targets in the Democratic Republic of Vietnam commenced, U.S. Air Force experts pointed out that circular probable error (CPE) amounted to 230 meters when bombing in combat conditions. At the end of the 1960's, however, F-105 pilots, for example, were able to reduce this figure to 110 meters when hitting undefended targets, and to 165 meters against defended targets. Circular probable error amounted to 175 meters when bombing heavily-defended targets. And yet prior to their arrival in Southeast Asia these pilots were achieving CPE of not more than 38 meters during practice bombing at Nellis AFB.

How can one increase effectiveness of combat sorties? According to reports in the foreign press, guided bombs were developed, with a semiactive laser guidance system. It includes a munition with laser heads and target designator located on board an aircraft or on the ground (in a forward air controller position). The target designator beam reflected from the target serves as a communications link which compensates for the pilot's errors in bombing, the time lag in aircraft bomb rack release, and ballistic errors not taken into account, which determine the magnitude of probable error. Various

techniques of combat employment of these munitions can be used, depending on the type and location of the target designator, the nature of the air defense, weather conditions, and a number of other factors.

In the opinion of foreign experts, when the laser target designator was carried on board the strike aircraft, the pilot was unable promptly to detect a small, concealed or camouflaged target when flying at low level. Range of bomb release and time required for accurate bomb guidance also decreased. In order to increase bombing effectiveness, it was necessary to illuminate the target with the laser target designator from the top of a steep climb, which the pilot would execute just prior to bomb release. But this increased probability that the aircraft would be destroyed by air defense weapons. Therefore U.S. command authorities were forced to designate a diversionary group and air defense suppression groups, which would continuously attack antiaircraft positions in the target area, preventing weapon crews from taking defensive measures, and diverting their attention from the bomb-carrying aircraft.

It is evident in Figure 1, for example, that after reaching the vicinity of the target (7), the F-4 attack aircraft, carrying a Pave Knife system and Paveway bombs, would separate from the diversionary group, which was attempting to neutralize air defense (6), and would attack the target from medium altitude (1). It was high enough to have sufficient time to correct the bomb trajectory and to evade hostile fire.



Figure 1. Approximate diagram of attack by an aircraft carrying bombs with a laser homing head.

Prior to a mission the aircrew would thoroughly study the target area on the basis of air reconnaissance data. Before commencing the attack, the pilot,

after TV-spotting the target, would visually identify it, while the Pavé Knife



Figure 2. Diagram of Paveway Bomb With Semiactive Laser Homing Head.

system operator would bring the crosshairs on the TV screen onto the target and lock onto the target for weapon tracking. The aircraft would execute a chandelle in the direction of the target and initiate an antiaircraft-weapon evasion maneuver (2). Then, continuing to track the target, the pilot would execute a brief climb (3), while the weapons officer would switch on the target designator to illuminate the target and form a cone of laser reflections from the target (4). After the bomb homing head locked onto the reflected beam, it would be released (5). The aircraft would maneuver (8) within the azimuth and elevation limits of the onboard target designator. After the bomb burst it would be switched off, but tracking of the target would continue (9) to evaluate bombing results according to the image on the TV screen.

This tactic, which was employed by U.S. pilots in Southeast Asia, was not considered highly effective, since a strike aircraft had to fly at considerable altitude within the antiaircraft engagement envelope to ensure expeditious target detection and target designation at a range of up to 70 km. In addition, due to the swiftness of the attack, they did not always succeed in expeditiously detecting the target, identifying it, and releasing their bombs. Therefore the subsequent evolution of a semiactive laser guidance system with target designator involved carrying it aboard a second aircraft. In many cases a target which was strongly antiaircraft defended would be attacked by a pair of Phantoms, one of which would carry Paveway bombs, while the other acted as target designator.

In weak air defense situations A-6 aircraft were used as target designator. They would illuminate the target, circling on a radius of up to 4.5 km from the target at an altitude of 5-6 km. The strike aircraft would attack from a circle and release small bombs from an altitude of 1.8-4.5 km and large bombs from 4.5-6.0 km. Employment of this attack configuration required precise coordination between the aircrews of the strike and assisting aircraft.

Upon approaching the target the Phantom pilot would establish contact with the A-6 aircrew, would receive target illumination confirmation and select a laser

emission receiver optical head scanning sector and bomb release configuration.

The optical head would scan in azimuth and elevation, in conformity with aircraft altitude and selected search range, and would lock onto the target after the aircraft turned onto closing course. Then the pilot would release his bombs at the preselected point and would break from the target with a missile-evading maneuver.

As was noted in the foreign press, CPE was reduced from 90-120 m to 3-3.7 m in the first range tests with laser-guided bombs. The effectiveness of the new weapon in combat conditions was promising. A total of 18,000 laser-guided bombs were dropped in combat in Southeast Asia, more than half of which struck their targets with minimal error. Analyzing employment of the new bombs, the Americans concluded that their extensive utilization was advisable.

Foreign observers noted that on the final days of combat operations in the Falkland (Malvinas) Islands the British also employed Paveway type modular-design bombs (Figure 2) with a semiactive laser homing head. The standard British 454 mm-diameter bomb was used as warhead (7), equipped with Paveway munition components. The nose section of the bomb guidance and control system (6) contained a homing head (1), a computer unit (2), control system (3), nose fins (4), and an adapter (5), while the tail section contained stabilizing fins with control surfaces (8). The specific features of employment of these bombs in the Falklands were determined by conditions, the nature of the targets, and characteristics of the Ferranti laser target designators. When providing air support to the landing force, the vertical takeoff or landing (VTOL) aircraft and helicopters of the British air strike force operated at high speeds at low and extremely low level and in many instances lacked adequate time to spot concealed and camouflaged ground targets. This was connected with the fact that the Argentine command authorities had deployed on the Falkland Islands an air defense system which included Roland and Tigercat air-to-surface missile systems, man-portable antiaircraft missiles, and small-caliber antiaircraft artillery. As is noted by the foreign press, the British lost five airplanes and more than 30 helicopters in the Falklands just to air defense fire. The VTOL aircraft were operating off the aircraft carriers "Hermes" and "Invincible," stationed 130-200 km east of the islands, which prevented them from spending much time in the target area, attacking the target on a single pass.

In order to reduce VTOL aircraft losses, the British employed laser target designators operated from ground formations to illuminate targets under attack (Photo 1) [not reproduced]. It was also planned to place them on board helicopters or VTOL aircraft, which would operate in teamwork with the strike aircraft against targets with weak air defense.

Eight LTM ground-operated target designator-rangefinders were delivered to the Falklands, two of which were lost as a result of a helicopter crash. This target designator weighs 9.5 kg and has an effective range of 10 km. A neodymium-doped yttrium-aluminum garnet cooled laser is used as emitter, which can operate, without recharging batteries, for 35 minutes in pulse mode with a 10 pulse per second frequency at an emission wavelength of 1.06 microns. Radio communication is maintained with the strike VTOL aircraft.



GR.3 Harrier VTOL attack aircraft, employed as laser bomb delivery platforms (Photo 2) [not reproduced], carried in their nose, on a swivel mounting, an LRMTS target search and coordinate determination laser unit with an effective range of 10 km and weighing 21.6 kg. Stabilization of the laser head is provided from 3 to minus 20 degrees pitch, plus or minus 12 degrees yaw, and plus or minus 90 degrees bank. Illuminated and locked-on target coordinates are automatically displayed on a collimator sight display, with which the pilot aims and releases his bombs.

The system operates according to the following principle. A forward air controller aims an LTMR ground target designator-rangefinder at the target and guides by radio the low-flying strike aircraft to the vicinity of the target. Informed that the target is being illuminated, the pilot switches on his LRMTS and selects a search sector for the optical head, which scans and locks onto the target on a closing course. The pilot determines distance to target by rangefinder, and the automatic tracking device locks onto and tracks the reflected laser cone and feeds data to the collimator sight display. The pilot then turns onto his attack heading, places the sight crosshairs on the target return, and releases his bombs at the prescribed range.

This principle ensures reliable target identification by a ground controller, and the pilot, who is short on time, does not need to search for the target visually. Any target tracking breakoff is eliminated. Essential, however, is precise coordination and sure communications between pilot and forward air controller, which in many instances was not achieved in the Falklands.

In addition, in guiding the strike aircraft onto his attack course it was necessary to use secondary ground reference points, signal flares, and even to drop bombs to produce craters as natural landmarks, and this made it necessary to pass over the target within the zone of hostile air defense fire. U.S. experts maintain that bombing with the target illuminated by a forward air controller is possible only in conditions of comparatively weak antiaircraft opposition.

On the final days of fighting in the Falklands, a ground laser target designator was placed by the British in the locality of Two Sisters and used to illuminate an Argentine 105 mm battery at Tumbledown. Harrier jump jets flew two attacks on the battery position and toss-released Paveway bombs from a range of 6-7 km from the target. This bombing configuration was dictated by the peculiarities of the terrain topography in the target area. A jump jet carrying two bombs on underwing pylons would approach the target at a height of 150 meters and a speed of 1,020 km/h. Above a selected ground reference point the pilot would pull his aircraft into a climb, counting off the time to reach a G-load of 3. At a pitch angle of 30 degrees the Paveway bombs would be released so that their line of trajectory would clear the summit of Mount Harriet and the bombs' homing head would lock onto the cone produced by the laser target designator beam reflecting from the target. The pilot would report release to the forward air controller and would immediately execute a turn, remaining beyond visual contact with Tumbledown. 11 seconds later the controller was to switch on the laser target designator. The time delay was to allow the bomb to reach the top of its trajectory at a height of 460 meters and transition to the descending segment of the trajectory up to the moment

the homing head detected and locked onto the laser beam reflected from the target.

On the first attack the forward air controller switched on the target designator too soon. The bomb was still on the ascending segment of its ballistic trajectory when the homing head locked onto the illuminated target. The command was given prematurely to the bomb's control surfaces, and it impacted 120 meters short. The second attack was more successful.

That afternoon the British hit a heavy-caliber machinegun position in the same area. Just as in the first instance, one bomb fell short due to premature target designation, while in the second attack the target took a direct hit.

Laser-guided bombs were also used by the British in bombing the airfield at Port Stanley. The strike was delivered by a pair of jump jet from high altitude. One Harrier delivered the actual strike, while the other served as target designator to illuminate the runway. The bomb was released from a dive, from an altitude of 10.7 km. The bomb-releasing aircraft was the leader, and the target designator carrying an LRMTS unit was the wingman. The Paveway bomb was released at an altitude of 7.6 km, but its homing head failed to achieve a solid target lock-on.

British Air Force experts believe that when the potential adversary has a strong air defense, survival probability is very small for such aircraft as the Buccaneer during target illumination. Therefore they believe that it is advisable to carry a Pave Spike system on board a remotely piloted vehicle (RPV), additionally equipped with a TV camera and a TV signal transmitter operating in conjunction with a ground or airborne command post. A CP operator identifies the target, determines its location from the TV image, adjusts the RPV flight path, and then gives a radio command to laser-illuminate the target.

Combat results with laser-guided bombs in the Falklands were of interest to NATO nation military experts, especially toss-bombing on mountain terrain. In their opinion utilization of a bomb-delivery aircraft and a ground laser target designator would be a successful combination in the Central European Sector, particularly in the southern areas of the FRG.

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